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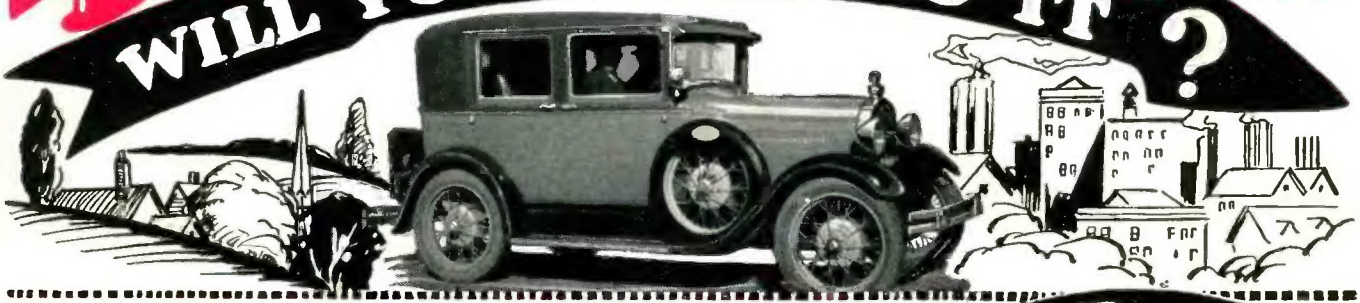

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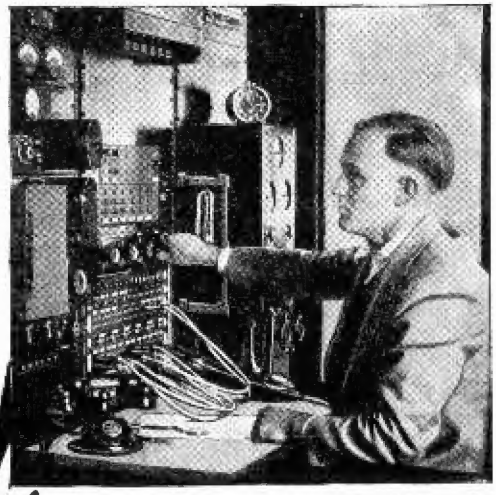

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In about ten years Radio has grown from a $2,000,000 to a $1,000,000,000 industry. Over 300,000 jobs have been created. Hundreds more are being opened every year by its continued growth. Men and young men with the right training—the kind of training I give you—are needed continually.

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Broadcasting stations use engineers, operators, station managers and pay $1,800 to $5,000 a year. Manufacturers continually need testers, inspectors, foremen, engineers, service men, buyers, for jobs paying up to $15,000 a year. Shipping companies use hundreds of Radio operators, give them world wide travel at practically no expense and a salary of $85 to $200 a month. Dealers and jobbers employ service men, salesmen, buyers, managers, and pay $30 to $100 a week. There are many other opportunities too. My book tells you about them.

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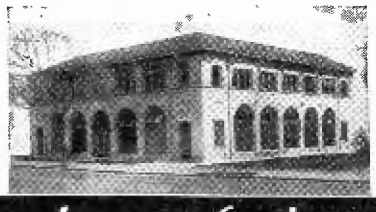
J. E. SMITH, President
National Radio Institute Dept., ODS
Washington, D. C.



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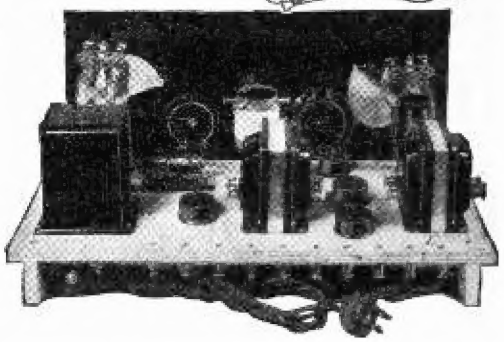

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Alloys— *a* New Basis *of* Wealth

By Alfred M. Caddell

Financial Editor

THE title of this article, I'll admit, is somewhat misleading. Alloys are not a new development in science and industry, but they most certainly are an increasingly valuable one.

Huge industries have already been founded on the mixture of metals and still larger enterprises are in the offing. Recently, a new steel merger came into being, the third largest steel company in the world, and among its most valuable assets are numbered processes for making stainless steel and other basic mineral compounds.

An alloy may be regarded as a marriage between metals, the properties of one element greatly influencing the properties of another element. For instance, a very small percentage of vanadium added to steel will bring about a steel of greater toughness and malleability. Manganese added to steel will bring about lightness with strength. Chromium added to steel will lend anti-rust properties to the compound. Allegheny metal is the name of an alloy which was developed in Germany during the war, when armament plants were seeking the hardest possible substance suitable for gun lining. At about the same time, the English also worked out the formula. After the war the commercial advantages of this alloy began to assert themselves.

This alloy is non-rusting, untarnishable, non-corrosive and not affected by weather in any way. It is also one of the hardest metals known to the steel industry. It is made of refined steel combined with about 18 per cent. of chromium, 8 per cent. of nickel and smaller proportions of carbon, manganese, silicon, phosphorus and sulphur. The process of combining these elements—a rather complicated one—gives the alloy its remarkable properties. Allegheny metal in itself represents a fast-growing industry capitalized in the millions. The automobile industry is becoming one of its chief customers.

Bronze, brass, German silver, pewter, britannia metal, babbitt metal, various solders, all serve as the foundations of industries that mount into huge totals of wealth. Bronze and brass are perhaps the oldest of all alloys, typical bronze being a mixture of copper and tin, and brass a compound of copper and zinc. This class of alloys varies greatly in composition. Manganese bronze, for instance, one of the variations noted above, is finding an ever increasing use in the making of steamboat and motorboat propellers.

Copper, steel and aluminum have served more or less as basic metals from which alloys are obtained by uniting other elements with them in specific proportions and by specific processes. Of outstanding importance in the development of aviation are the aluminum alloys.

Copper is perhaps the commonest of alloying elements used with aluminum, with magnesium and manganese playing important parts in rolling and forging alloys, and with silicon, nickel and iron used extensively in alloys for the foundry. Duralumin is the best rated alloy from the standpoint of strength. Alclad, another aluminum alloy, has outstanding non-corrosive qualities. Both duralumin and alclad are used extensively in the construction of airships, an industry which has barely gotten under way. Alclad, for instance, weighs only one-third as much as carbon steel of the same strength. Thus it is admirably fitted for aerial use.

In aircraft use and more particularly in the construction of power plants, it has been found profitable to pay even a very high price for any appreciable saving of weight. In fact, the present relatively high cost of aviation motors, it is said, is due to the extensive use of alloys—more than fifty per cent. of the weight of the average aviation motor is made up of aluminum alloys.

Where metallurgical research will take us in the fields of industry is most difficult to say. But the investor in industrial securities can well afford to follow such developments with the greatest care.

Questions and Answers

Conducted by Alfred M. Caddell

Information on securities will be furnished readers of "Science and Invention" free of charge by mail and through these columns. A 2-cent stamped, self-addressed envelope should be included in your letter. Address your inquiries to the Financial Editor, Science and Invention, 381 Fourth Avenue, New York City.

Question—Kindly give me your opinion of International Business Machines. L. L. L., Toledo, Ohio.

Answer—The earnings record and growth of International Business Machines have been excellent. Earnings have increased every year since 1921, and a larger cash dividend has been paid in each year since 1919. The stock pays $6 a share in cash per year and also distributes 5% in stock. The trend in factories, banks, officers, etc., is steadily toward labor saving. There is no let-up of business in sight and consequently this company should register steady progress of a more or less continuous nature.

Question—I am considering the purchase of Chicago Pneumatic Tool common. What is the outlook for this company? A. C. B., Dallas, Texas.

Answer—This company is the largest manufacturer of pneumatic tools in the world, manufacturing so-called hand tools, air compressors, gas and oil engines of the Diesel and semi-Diesel types, rock drills and other appliances which are sold to a large and diversified number of customers. Capital readjustment was effected in 1928 which brought about a better type of set-up. Earnings have increased since 1921 in varying degree and substantial working capital has likewise been added each year. The stock has recently moved ahead on comparatively small buying orders, reflecting a limited floating supply. In view of the steady growth of this business, the future of which seems entirely sound, this stock may be regarded as a conservative speculation. Up to date no dividends have been paid on the common.

Question—I hold Standard Oil of New Jersey, Phillips Petroleum, Associated Gas & Electric "A" and Commonwealth & Southern. How do they rank? L. P. D., Albany, N. Y.

Answer—All good. The oil stocks are of the best, able to withstand the ups-and-downs of conflicting markets. The utilities have excellent merit. Steps are now under way to eliminate minor holding companies in the Commonwealth & Southern group, thus effecting a more workable set-up.

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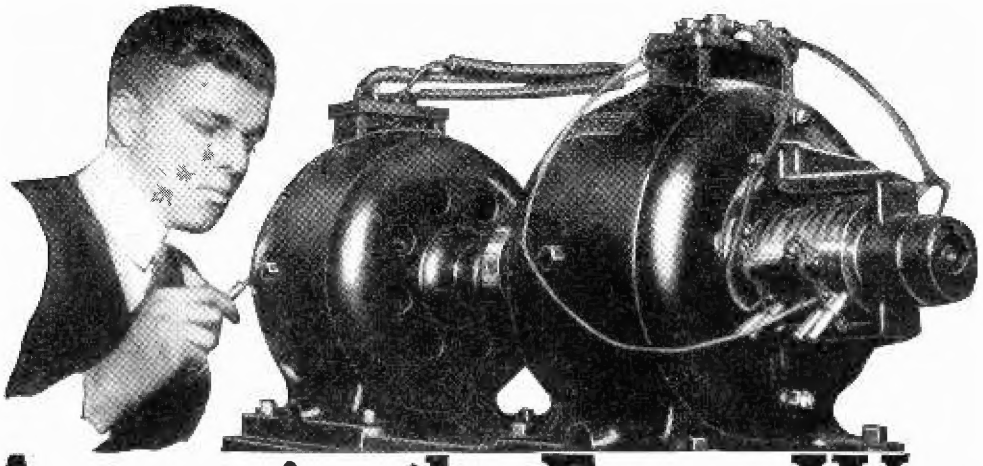

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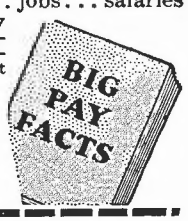

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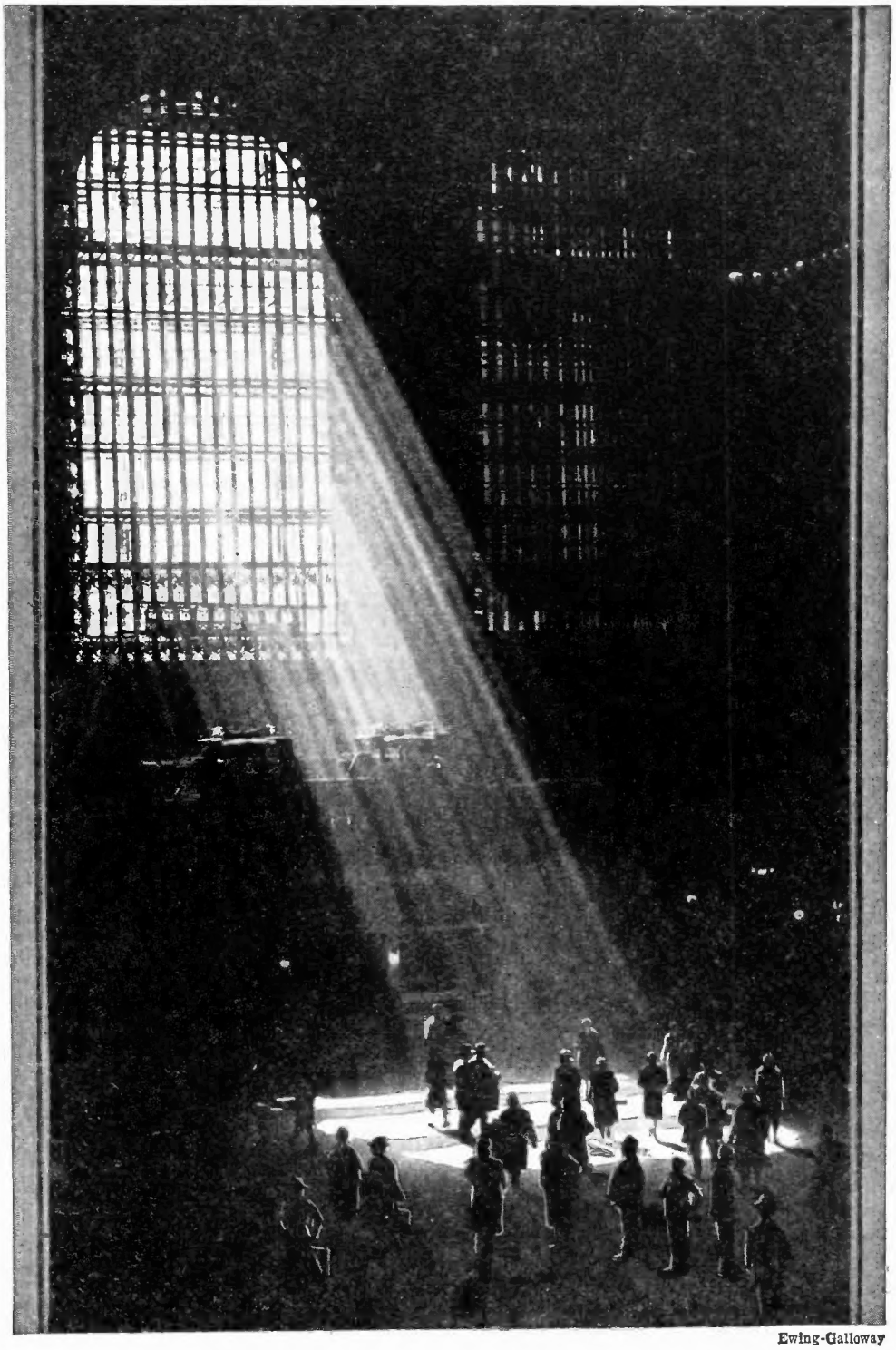

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An atmosphere almost cathedral-like characterizes this photograph of the Grand Central Terminal, New York.

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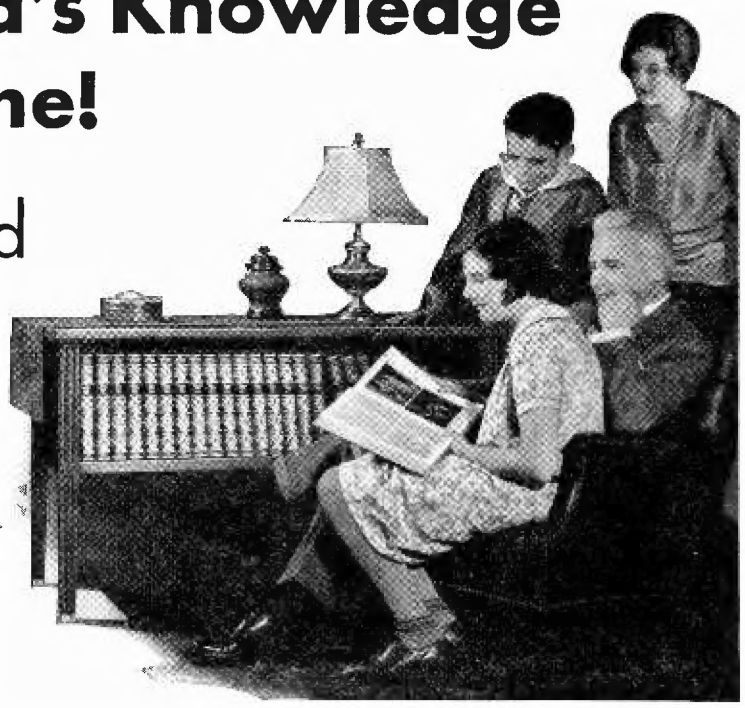

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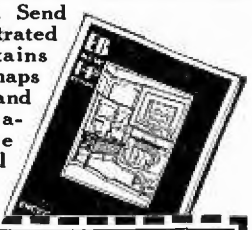

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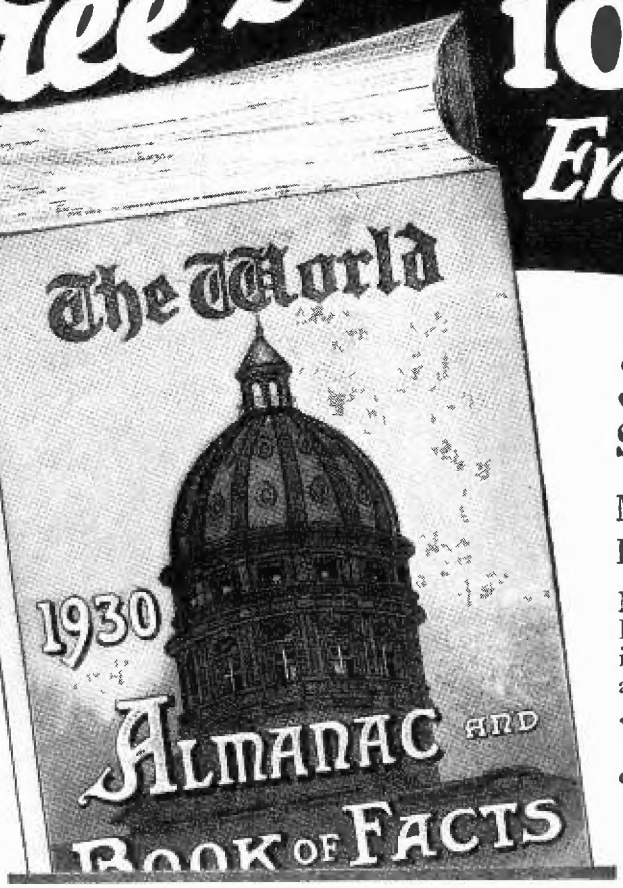

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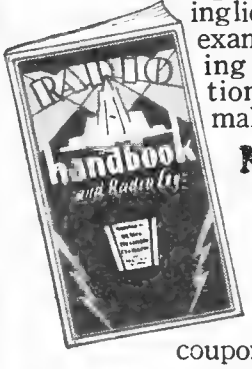

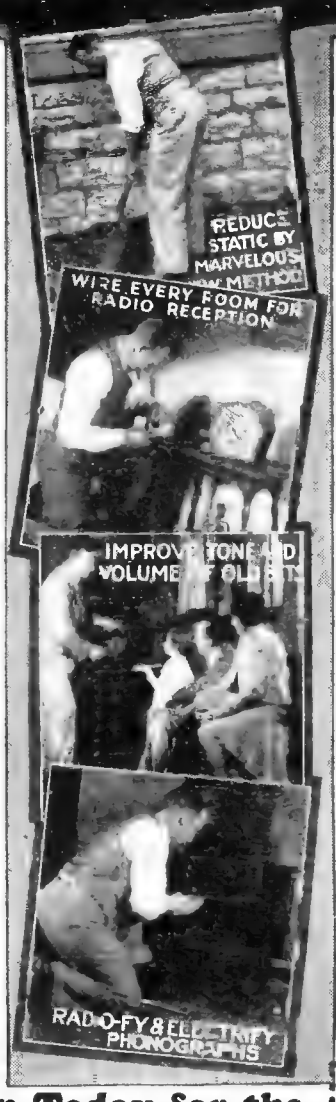
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APRIL, 1930
NUMBER 12

Science and Invention

VOLUME XVII
WHOLE NO. 204

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Editorial

The Great God of Science—Heat

TO most of us the word heat casually conveys little more than an idea of warmth. We think of it mainly in terms of bodily comfort or cooking, and are generally well satisfied to have scientists and engineers deal with other uses of this important agency.

When Moissan, the celebrated French chemist, began experimenting with electric currents to produce heat, little could he have realized the almost unlimited industrial expansion that was to follow in the wake of his investigations. Not content with startling the world by making real diamonds by an artificial process, he went on to discover new substances and laid the foundation of industries which have exercised a profound influence on the course of human destiny. Substances of great industrial value, which were scarce because they were not amenable to temperatures of the blast-furnace, became conveniently available in quantity and in a high degree of purity. A fresh impetus was given to industry and new factories sprang up wherever power was available for the generating of electricity.

To appreciate the importance of the electric furnace and the research work which preceded its development, let us consider the temperatures available by other means. The temperature of a blast furnace probably does not exceed 1,600 degrees Centigrade at its hottest point. The Bunsen flame, fed with the proper mixture of gas and air, provides heat up to 1,870 degrees C.; 2,000 degrees C. is produced by a mixture of oxygen and hydrogen, and 2,400 degrees C. by a mixture of oxygen and acetylene. Great use has been made in industry of the oxy-acetylene torch.

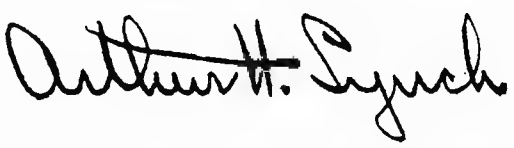
But by none of these means can the maximum temperature of the flame be communicated to the substance on which it plays. By one means and another heat quickly becomes dissipated. However, the conversion of electricity into heat is brought about somewhat differently. The passage of a current through a conductor is attended by the production of heat, and the greater the proportional resistance which the conductor offers, the greater is the intensity of heat produced. Utilizing this principle, Moissan constructed a furnace, through the walls of which were inserted carbon rods. Then a high-voltage electric circuit was connected to these rods which met just above the substance under experiment, and upon being separated the electricity bridged the gap between the carbon points in the form of arcs and produced a temperature which has been estimated to have reached 3,500 and possibly 4,000 degrees C. What Moissan had produced was in reality a glowing crater.

In the presence of this terrific heat it was discovered that certain metals would not only melt but boil. Many substances, such as chromium, manganese, tungsten, molybdenum, titanium, vanadium and silicon heretofore had been chemical curiosities, obtainable only at great expense. Now we find them in abundance in every-day use. By combining them with steel in the electric furnace metallurgical chemists have given us some wonderful alloys.

Automobiles, airplanes, various parts of machinery, tools, guns and the like owe their progress in development to a large extent to the quantity and cheapness of substances which improve the quality of the steel used in their construction. Chromium confers on steel toughness, tungsten and molybdenum hardness, titanium soundness and vanadium strength when added in the proper amounts; manganese in quantity greater than 8 per cent. gives exceptional hardness combined with ductility, and destroys the magnetic properties of steel. Silicon lends elasticity for the making of springs.

And aluminum! The commercial practicality of aluminum owes its existence entirely to the electric furnace. Though occurring in abundance throughout nature, it was virtually impossible to refine it with the comparatively low heats available prior to the electric arc method of obtaining high temperature. Without aluminum and its various alloys many industries, and consequently much progress, could never have been made.

We might continue almost indefinitely, each achievement in the field of alloys and in many other fields of endeavor emphasizing the tremendous importance that must be attached to the development of the electric furnace. But apart from the extent of this major development, we must give heed to the importance of all research. One discovery alone, no matter how apparently insignificant at the moment it may appear to be, may prove to be the opening wedge of an almost endless number of subsequent developments.



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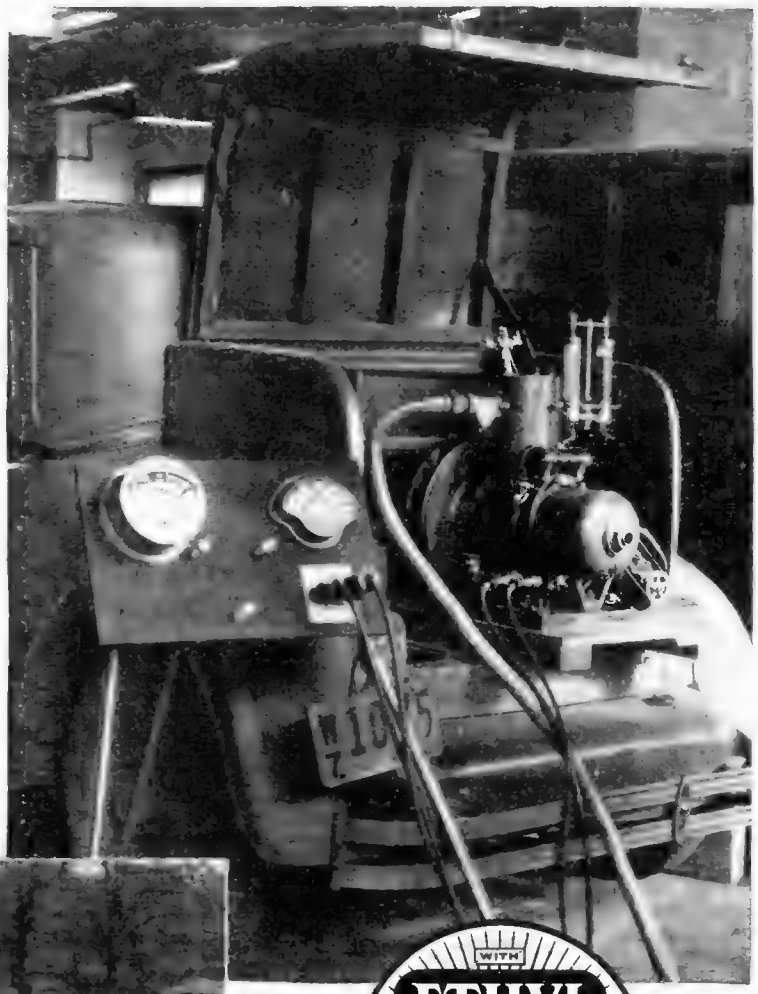
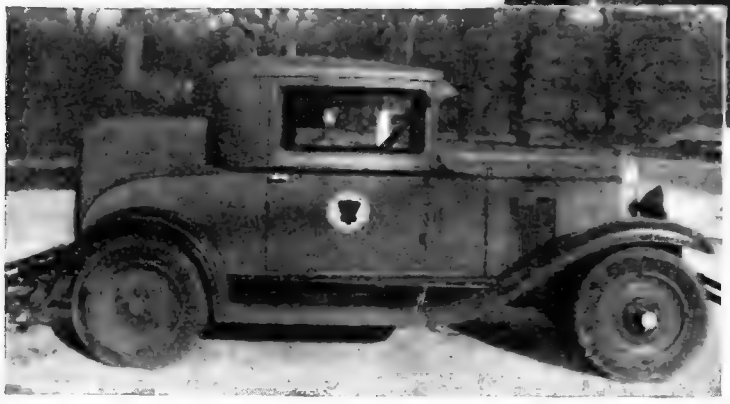
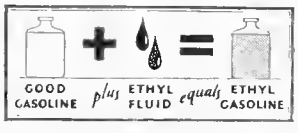




WITH ETHYL BRAND OF ANTI-KNOCK COMPOUND ETHYL GASOLINE CORPORATION NEW YORK, U.S.A. Knocks out that "knock"

Fitted into the rear of this car is the "knock" demonstration machine. (Above at right) The machine ready for action



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ETHYL GASOLINE

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SCIENCE *and* INVENTION

Volume XVII. Number 12

APRIL 1930

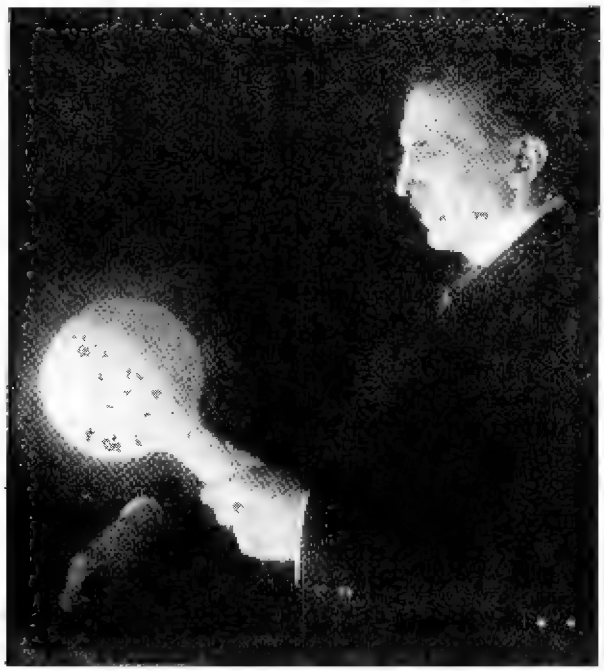
Tesla Maps Our Electrical Future

Simple Daylight Television, Baby Electric Planes, Cosmic Rays of Tremendous Intensity Foreseen by Scientific Wizard

By H. Winfield Secor, E. E.

DO you use an alternating-current induction motor? A high-frequency coil? A filamentless vacuum lamp (such as the neon lamp)? . . . At least you know these things and benefit by their use, as most of us do who live in this modern age of wonders. And you will be interested to know that not only these but many other modern electrical methods and appliances are conceptions of the brain of Dr. Nikola Tesla, perhaps the greatest master of electricity alive today.

Fundamental—that is the word that tells best why Dr. Tesla's name is less commonly heard than that of Edison. For practically half a century Dr. Tesla has occupied himself with the roots and essences of his chosen subject. How essentially necessary to modern industry, offices, and homes is alternating current! For most industrial requirements, direct current is not suited at all. Long-distance transmission of such a current is wasteful and impracticable, as no simple, efficient machinery is available for generating and transforming it at high voltages. Alternating current, on the contrary, lends itself admirably to high voltage generation and to transformation into current of any strength or volume as well as into direct current, at the point of use. . . . Without alternating current, in short, we could not proceed with modern life. Yet more than forty years ago Dr. Tesla discovered the principle of this form of electricity, invented machinery for generating and transforming it, and introduced it to a world which until then had been limping along with direct current as best it could.



One of Dr. Tesla's striking experiments. A blare of light produced in a filamentless bulb by wireless power transmitted from a loop carrying terrific currents oscillating eighty million times per second.

Dr. Tesla's service in this immense field opened up by him is summed up strikingly by Dr. A. B. Behrend, in his book on the alternating-current induction motor:—"Were we to eliminate from our industrial world the results of Mr. Tesla's work, the wheels of industry would cease to turn, our electric trains and cars would stop, our towns would be dark, our mills dead and idle. So far-reaching is this work that it has become the warp and woof of industry."

Because Dr. Tesla knows the principles of electricity and has checked his knowledge in practice, he is able to speak with certainty about electricity not only of today but also of tomorrow. . . . His forecast of the electrical future is not that of an imaginative "philosopher," but of an experimenter and calculator. He is sure of what can be done, because he knows what has been done—by himself. Some results of some of his conclusions he imparted to me in a recent interview.

"Neon lamps are in the public favor and are being used for store windows and in signs (*Continued on page* 1124)

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Two 40-foot pavements on a 204-foot right-of-way make Grand River Road a thoroughly modern motorway. At this intersection 35,955 vehicles pass each 24 hours, on busy days.

By J. Lee Barrett

President of the Detroit Automobile Club

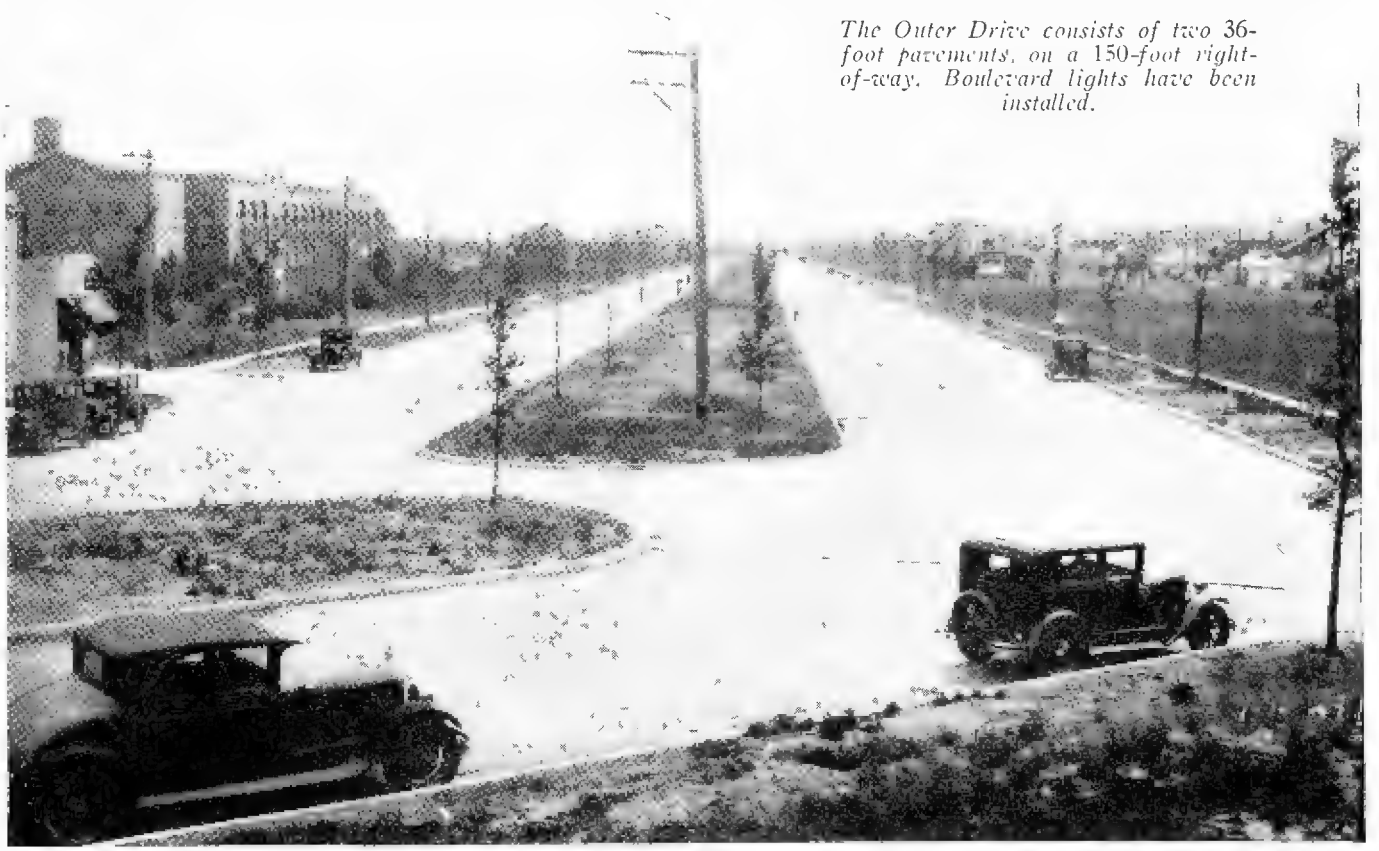
WHEN the Governor and Judges laid out the 200-foot main arteries and 120-foot intermediate thoroughfares of the original plan of Detroit, there was no means of knowing in what measure or for what purpose they would be utilized by subsequent generations. Unfortunately the vision of a great future was lost in the first decade, but in that period a few sections of the wide thoroughfares of the plan became established in the city.

Have they become a nuisance and a burden to the taxpayer in the six generations that have elapsed, or have they served to the limit the different needs that each generation found for them?

The answer lies in the enormous structures that now adorn Washington Boulevard; in the teeming department store activities of lower Woodward Avenue; in the magnificent upbuilding that has come to Cadillac Square; in the great hotel, theater and private club development about Grand Circus Park, radiating into the short sections of Madison and Bagley Avenues and Broadway that are left in the plan; but more than all, in the eight-mile length of East Jefferson Avenue, which has met all the transportation demands that the ensuing generations have put upon it with its concentration of industries, apartment houses and recreation centers.

However, with the development of the automobile and with increased traffic congesting Detroit's main arteries,

The Outer Drive consists of two 36-foot pavements, on a 150-foot right-of-way. Boulevard lights have been installed.



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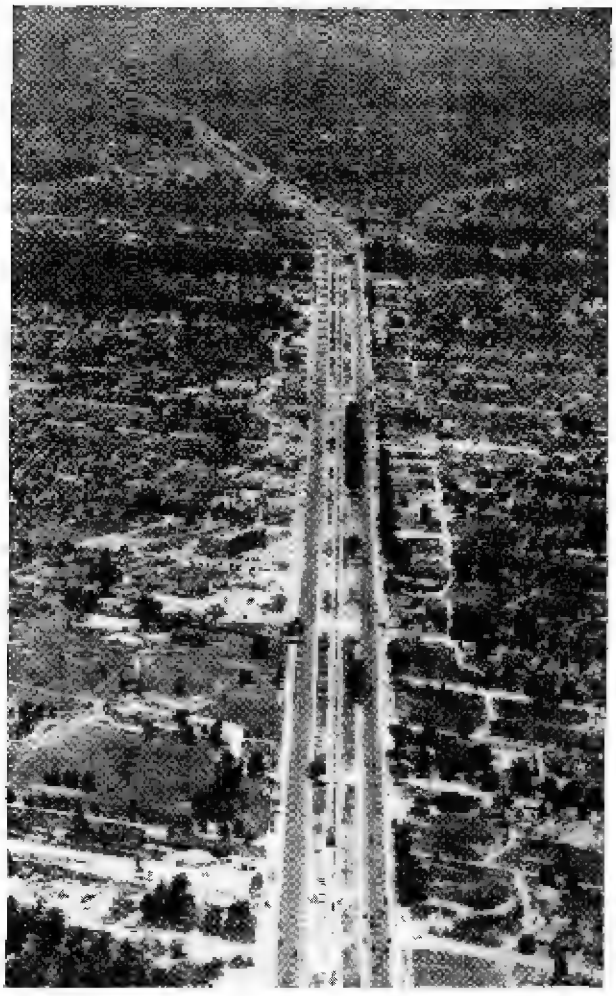
ways Motor Age

Traffic Are the Most Pressing Problem Here Is What Detroit Is Doing to Pro- for the Rushing Motor Cars of Today.



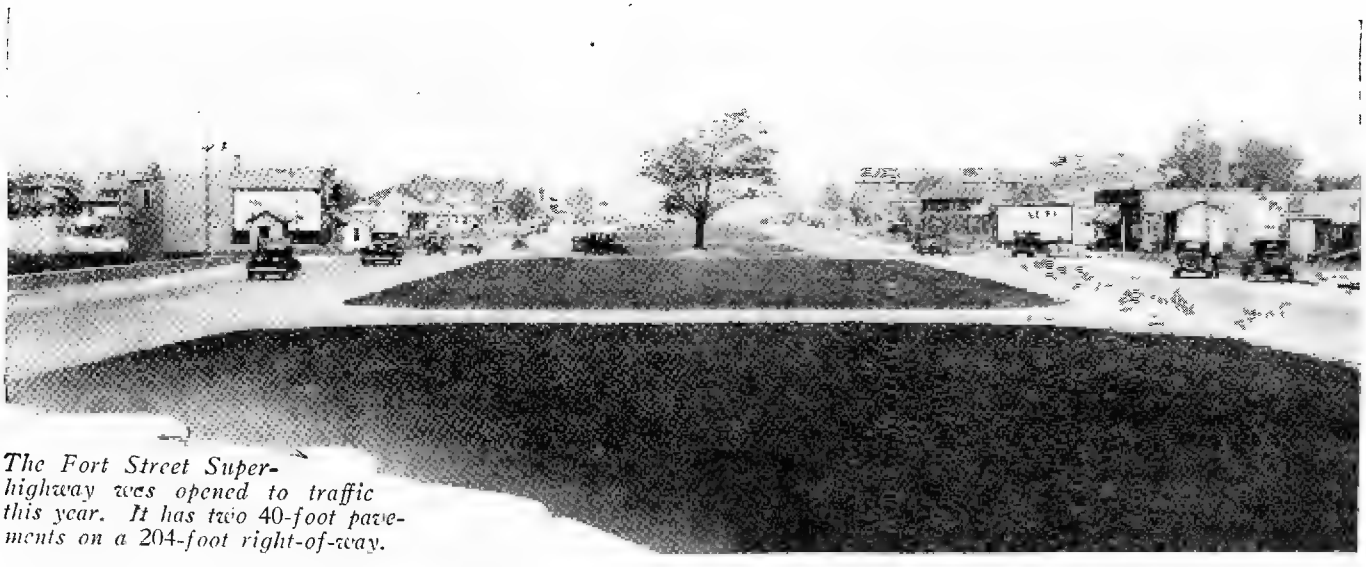
Woodward Avenue Superhighway connects Detroit with Pontiac, more than 25 miles away.

road commissions and city officials realized that a unity of effort would be necessary in order to maintain the heavy traffic on Detroit's streets. Consequently, in 1925 the City Plan Commission presented to the Common Council a plan known as the Master Plan embracing not only the streets within the city limits but superhighways extending into three counties. Superhighways outside of the limits called for a width of 204 feet and main arteries within the municipalities, for a width of 120 feet. This plan being a scientific development received by road commissioners from the three counties and City Plan commissioners, was approved by the Council and by the people of Detroit and an additional one mill was added to the tax levy to provide funds for this work.

For the past four years a large portion of this Master Plan has been developing rapidly. These 204 feet superhighways are designed to offer a space on a single level for the free movement of through automobile traffic at high speed as well as for local traffic and provides an exclusive reservation for the rail rapid transit lines that the expansion of the city will require for the mobilization and distribution of its armies of workers. The future city will be able to put its transit facilities on the surface at a great economy in more than three-fourths of its transportation area, because of the measures that are being taken now to acquire the right of way in advance of development.

These projects have advanced much more rapidly in the districts surrounding Detroit than in the city itself where the plan is hampered by business development which has already grown up on these main arteries. Some opposition has been advanced due to the special assessments which are levied against the property improved—by the widening thoroughfares.

At present. Detroit has five main arteries centering in the business district with two cordons, one circling the city at the three and one-half mile circle, the other known as the Outer Drive circling the city at the eight-mile circle, the latter being a 204-foot boulevard providing for cross-traffic between the five main arteries. (*Continued on page* 1133)



The Fort Street Superhighway was opened to traffic this year. It has two 40-foot pavements on a 204-foot right-of-way.

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It's Outboard Time!

You can get quite a thrill on a skiboard equipped with an outboard motor. Richard Dow and his dog, "Princess," are doing the bounding bounce.

EVERYONE has seen an outboard motorboat being propelled at a high rate of speed. Very few know that the outboard engine can also be applied to some unique constructions.

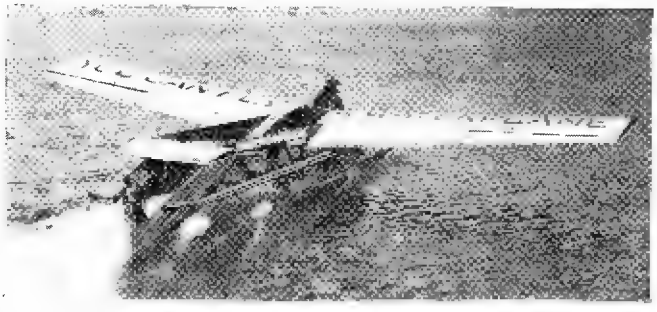
Skiboard Skims the Deep

THOSE who have not experienced the thrill of standing on a skiboard towed by a swiftly running outboard motored craft or by a fast power boat have often evinced a desire to try it. Such pleasure had never been reduced to the ultra-simplified form of attaching the outboard motor directly to the skiboard until Richard Dow decided to put the thought in practice, and now on any sunny day he can be seen giving his dog a speedy ride on this unique craft. Both seem to be enjoying it.

Gas Your Outboard As You Go

DURING the outboard motorboat races at Oakland, California, a new system of refueling was tried and found very successful. Dr. F. T. Barron equipped his outboard motorboat with a pipe line to the end of which a flexible hose was secured. Then as Oran Fageol was putting his vessel through the pace, Dr. Barron pulled up alongside and transferred gasoline to Fageol's boat while both were running at full speed. It is likely that refueling records for outboard motorboats will soon be attempted and probably boats in such classical races as the Albany to New York feature could receive fuel en route in this fashion.

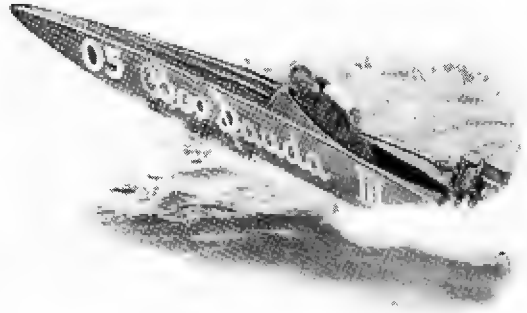
You Can Be a Naviator Now



ANYONE can "fly" this waterplane. The sign on the wings says so. This vessel was designed for even greater thrills than ordinary outboard motorboat racing provides. It has been claimed that this motorized Mother Carey's chicken can make 65 miles an hour without flying any more than several feet above the surface of the water. As a matter of fact, if the motor mounted on the rear pontoon were not in the water all the time, the monoplane would lose headway until the engine were submerged again. Ailerons supply stability and an elevator fin gives an up and down motion. The waterplane is steered by a submerged rudder and was built in Alameda, California.

Like a Porpoise at Play

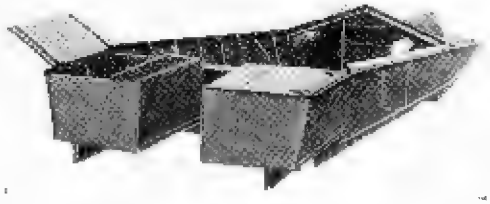
AUSTRALIA has also taken to the outboard motor craze. At the Royal Motorboat Championship held by the Royal Motor Yacht Club.



aerial acrobatics were indulged in by the holder of Australia's outboard motorboat championship. Those who attended the carnival were surprised to see an outboard motor craft literally bounce out of the water as it sped along. A cameraman was on hand to photograph the bouncing boat.

At Last—the Pneumarine!

THIS stepped hydroplane hull furnishes itself with a pneumatic riding cushion as it goes along. Two streamline funnels at the fore part of the vessel drive air beneath the vessel, relieving the suction between the water and the



bottom of the boat and increasing its speed. The dotted white lines show pipes communicating with the bottom.

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What's New *in* Radio?

What's Sunshine to Us May Be Static to Him

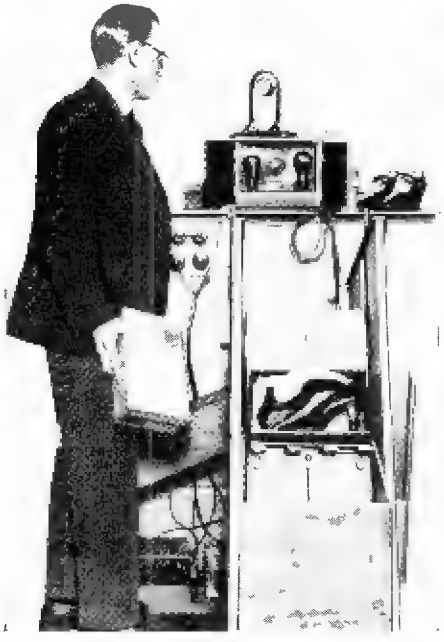
PROFESSOR PAUL DE MARS of Tufts College is shown making an observation during the extensive investigations he has been conducting to determine the effect of the sun and the upper atmosphere on radio transmission and reception. Everyone who has a radio no doubt has noticed the wide variation in the effectiveness of reception from winter to summer and from day to night. With this machine, especially designed for this investigation, Doctor De Mars hopes to be able to determine the most advantageous conditions for broadcasting, and also to recommend to the radio industry means of preventing improper reception due to unfavorable atmospheric conditions.

Radio Teaches Them "Ups and Downs"

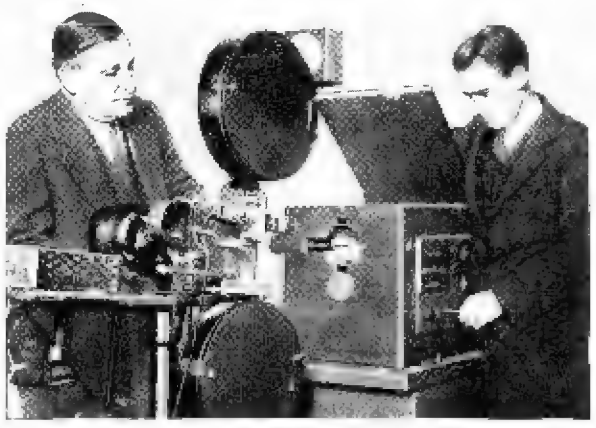
EMBRYONIC flyers who would learn the fine points of the art of flying now have an added instructor in the form of radio communication. At the Heston Airdrome in England the student pilot is first given instructions by the teacher who then communicates with his pupil, in the air, by means of a radio system located in a nearby tower. Captain V. H. Baker, chief pilot of the Heston Airdrome, is shown here giving some advice to his apt and pretty pupil, Miss Betty Cleaver. You will notice the earphones, worn by Miss Cleaver, which are attached to the receiving set contained in the plane. Perhaps pilots will not relish the removal of the personal touch from the teaching of pupils like this one.

Call Off Your "Dogs"

"SIZE 6, No. 5143," a salesman in this Regent Street Shoe Shop in London might call into the microphone. The request would be amplified and received through a loudspeaker in the stock room. And the shoes are sent to the showroom on an endless chain. Here we see a salesman about to take the shoes from the chain. Below is the microphone and the sound system which conveys the order to any of the other departments in the building. Here's one job less for the errand boy to perform.



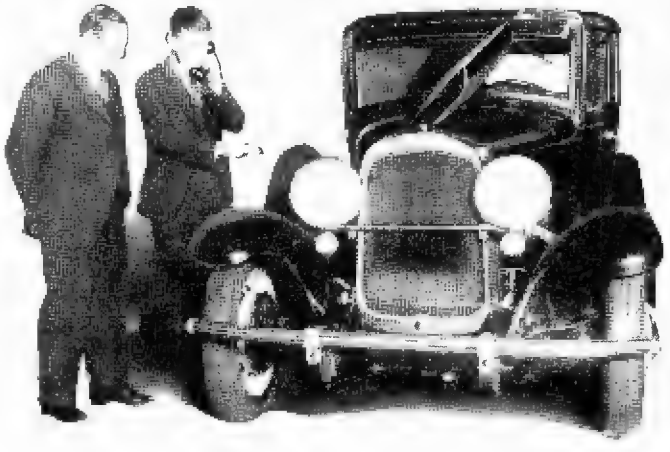
Mormon Youth Aims to Simplify Television



PHILO FARNSWORTH, twenty-three-year-old Mormon inventor of San Francisco, has recently perfected a televisor which uses no scanning disk. According to the backers of this invention, television now becomes as simple a matter as learning the alphabet, for most of the movable and noisy parts have been relegated to the same limbo as the crystal detector radio sets.

Back Seat Drivers?—Here's Outside Driver!

R. H. MAXWELL of the Westinghouse Company recently gave a demonstration to A. W. Picketts of the Willys-Overland Company at the automobile show in New York in the controlling of an unoccupied motor car by speaking directions to it through a telephone control. By means of the "electric eye" the car was made to respond to such matter-of-fact commands as, "Back up, please," "Turn lights bright," and a few others. However, this apparatus is quite temperamental and depends for its response on the quality of the voice of the commander.



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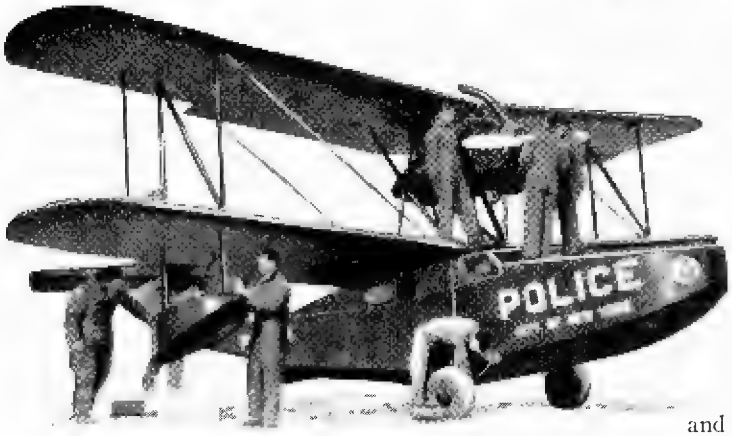
The Long Arm *of*

When the Modern Police nal Today, Aviation, Motor at His Elbow to Assist Him This Article Surveys the Science on the New

By Mary



Airplane mechanics keep police aircraft in perfect trim for patrol and emergencies.

WHAT is a policeman?

The answer was easy—once. Not so now. The reason? Our forces of the law have called science in to help them make crime difficult and apprehension sure. And scientific police methods are creating motor mechanics, thumbprint specialists, and ballistic experts where only policemen grew before! Further, aside from these specialists, a new kind of patrolman has emerged—a man who knows the essentials of scientific criminal-hunting and is able to apply them.

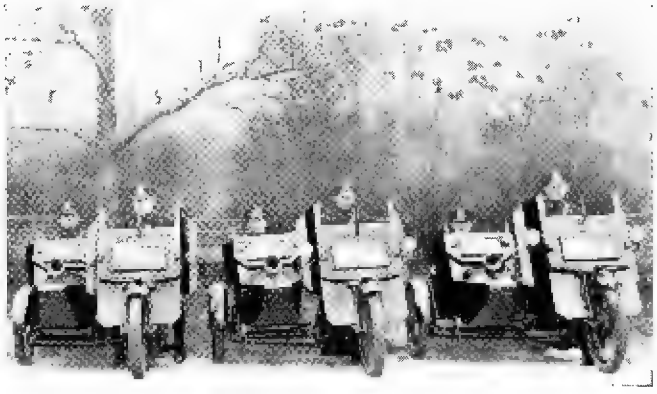
New York is a good example of the changes that are taking place in police departments under scientific rule. The New York Police College is utilizing the latest scientific equipment for all the phases of police work—from gathering evidence to discussion of explosives and their action; from the study of ballistics in connection with the identification of bullets to ground work and flying instruction for the aviation force. The school accommodates 2000 men who have come from all of our forty-eight states to train for the latest profession, the profession of policeman.

Science determines a rookie's entrance into the police field. A department physician examines every candidate; they must be physically perfect, mentally alert and intelligent Fingerprints are taken. Once accepted, the rookie receives a training that is rigid and extensive.

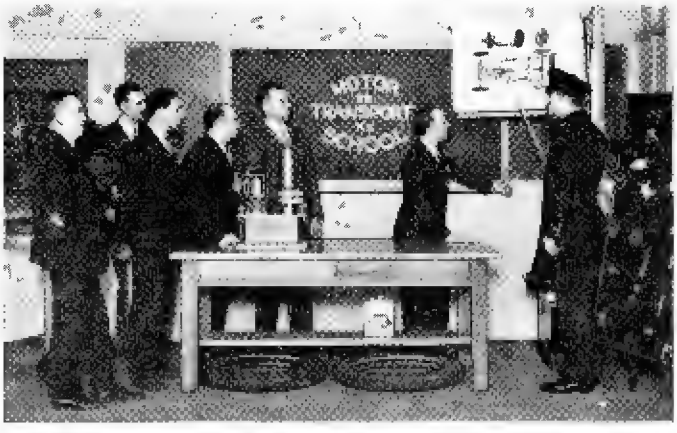
Each recruit must become acquainted with criminal law and court procedure. He studies the famous cases of criminal history, often under tutelage of the very men who have helped solve them. He is told how to interrogate suspects, when to make arrests, what constitutes legal evidence . . . no phase of his work from apprehension to conviction is omitted.

Play, too, forms an important part of the official training. Calisthenics, wrestling, rough and tumble fighting, and jiu-jitsu are taught so that the policeman will be capable of defending himself against wrongdoers. A complete course in marksmanship—the construction and care of firearms, the ability to shoot straight and to disarm your opponent—is included as a further means for defense and protection. The modern holdup man with his pistol has rendered this imperative.

As a matter of fact, the only way to combat crime is to know all the underworld's methods. For this reason a museum is set aside for the display of weapons. Each recruit is taught their use—whether they be three-pronged crowbars or can openers, rope and wire ladders used for scaling walls, sawed-off shotguns, miniature pistols, wood and lead mallets for noiseless tapping of safes, or cane guns. Many such weapons are made doubly dangerous by ingenious camouflage. Open up a common fountain pen—it will fire a 32-calibre bullet. Lift a pearly knife, touch its blade—a bullet will spurt forth. A bullet-proof vest, from which the gunman is rarely separated, is on display; such a garment provides one of the best means of identification.



Armored motorcycles stand in readiness to hunt down high-speed criminals.



Under Captain James Connelly these men teach students the working principles of police motor transport.

Bullets themselves provide an excellent means of identifying criminals, for no two pistol bores are identical. When a gun is fired the bullet records all imperfections of the inside barrel; thus the bullet identifies the gun. Microscopes, micrometers, spring gauges, all play their share in ballistics for the recruit.

Fingerprints, of course,

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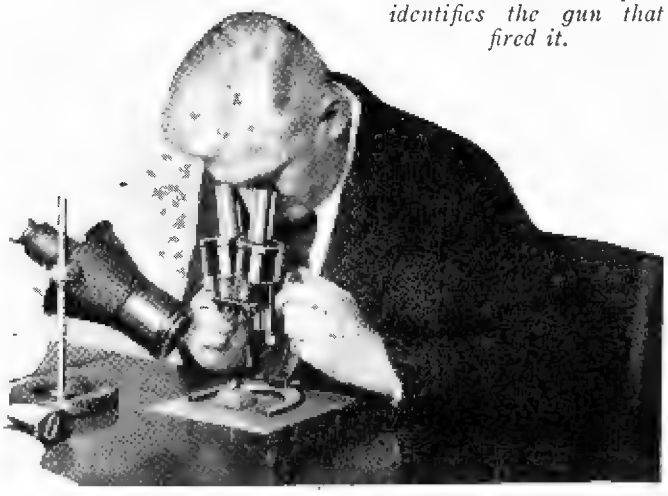
Science

man Starts After a Crimi- Mechanics, and Ballistics Are in Trapping the Misdoer . . Many Rôles Played by York Police Force

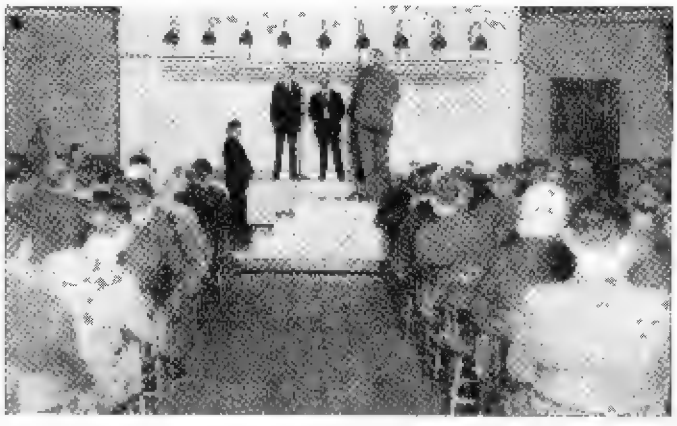
Jacobs



By the marks left on a bullet the ballistic expert identifies the gun that fired it.

present the one infallible, unchangeable source of recognition. Let the criminal scar his finger tips, file them down, mutilate them with chemicals—nature's pattern persists. There is no escape, all fingerprints come within one of the nine human types. Accompanying photographs of fugitives are detailed views of his fingerprints; these have been telephoned abroad, when occasion demanded, to aid in his capture.

All wrongdoers are fingerprinted immediately upon reaching headquarters—before they parade in the line-up—that daily procession of suspects and criminals who must furnish details of their careers for the recruits and detectives stationed in the audience. Microphones enable the questions and answers to be heard distinctly, for future reference And by seeing these culprits daily, policemen become familiar with the various offenses and types of offenders.



Suspects and criminals are questioned by the Deputy Chief Inspector under the gaze of detectives, in the daily lineup.

Practical application of chemistry, biology and physics, so far as they affect police work, is provided. Policemen must be able to make minute examinations of hair and blood, dust particles, poisons, stains, counterfeit coins and notes, disguised and imitated handwriting. Photometry and luminescent analysis are considered in laboratory work.

After the general course of training, the future guardians of the law are classified according to their capability and aptitudes for special training.

The Motor Transport School gives thorough instruction in construction, care, repair and operation of motor vehicles; practical demonstrations and road tests. All New York motor policemen must pass the state automobile license tests. The Motorcycle Squad, which works together with the mounted officers in handling traffic, receives schooling in operating motorcycles.

In the School of Horsemanship the mounted policemen are trained to ride properly, to care for injured animals. A veterinary surgeon gives lectures on the anatomy and health of the horse. . . . The horses, too, come in for their share of instruction before ready for use. They must become accustomed to the sound of revolver shots, explosions, and seeing fires.

The School of Aviation is about the finest of its type in the United States. Actual laboratory work in the construction of planes, explanations of the various kinds of propellers, discussions of the controllability of planes, and their stability, are stressed. Work in manufacturing plants where planes are being constructed is included for the prospective aerial policeman; both the Curtiss and Roosevelt fields serve as training bases. The engine mechanics division of this school covers fueling systems, scientifically analyzing fuels and oils used for power. Pupils must pass a rigid test and qualify as commercial mechanics before they may take part in this phase of police activity. Dual and solo flying, the Department of Commerce rules for operating planes over cities, even meteorology, are part of the New York Police College training for its young aviators, pioneers in the first regular patrolling city air police force.

Aerial policemen have a double responsibility—to the aviator and the pedestrian. Whether a citizen is walking on the street, riding in his car, standing in front of his house, or doing stunts in his plane—safety is provided him. Private property must be protected against any damage from flying planes; reckless flying and other infractions of flying regulations must be stopped. Every other department of police activity may call upon the Aerial Unit for aid whenever the emergency requires.

The ballistic laboratory is equipped for complete study of projectiles and weapons used by criminals.

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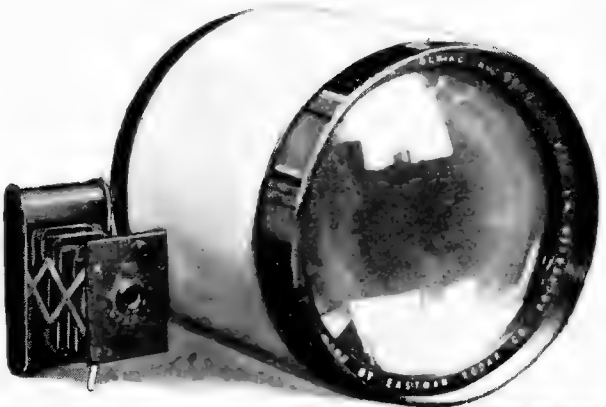
Brains *of* Silver— Eyes *of* Glass

Modern Production of Camera's Vital Features Makes Possible Your "Vest-Pocket" Photography



The largest photographic "eye" ever ground in America forms a remarkable contrast to a folding camera of vest-pocket size. It was made for the army air service.

Photos courtesy Eastman Kodak Co.

A FILM coated with an emulsion of silver and a lens of polished optical glass are the very vitals of the folding camera with which you make picture records of interesting moments in your life today. It is only since the process of making these "brains" and "eyes" of our cameras has been perfected that amateur photography as we know it has been practicable.

The problem of the film — of the "brain" that records and holds what the lens has seen—was most difficult. In the early "wet-plate" days, the amateur sallied forth with a trunk-size camera and a whole laboratory of equipment, together with a tent in which to house it during his breathless experiments. . . . For experiments they were. The process of shooting a scene and developing a plate was a succession of emergencies, and the photographer who consistently got good results was regarded as little less than a magician.

Dry plates did away with the tent and the ponderous field equipment. But they were heavy in themselves and far too frail to encourage a rapid increase of amateur camera men. In 1889, however, the nitro-cellulose film base was discovered, and amateur photography began to come into its own.

Incidentally, but by no means unimportantly, the same discovery made possible the motion picture. The transparent, flexible nitro-cellulose film was the one essential needed to enable Thomas Edison to carry his cinematographic experiments to a successful conclusion. So 1889 marks the date when the movies began to come into their own, too.

How far photography, moving and still, has come since 1889 may be judged by the fact that 5,000,000 pounds of cotton are consumed annually in making basic film at the Eastman works alone. And the consumption of silver bullion for film coating at the same plant is one-tenth of that used for all purposes by the entire country.

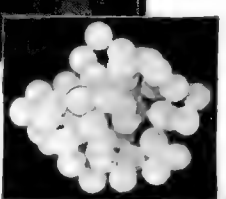
Purity and cleanliness are prime considerations in processing cotton for basic film manufacture. Washing and drying is carried out over a period of weeks, and impurities of the more persistent sort are removed with caustic soda in rotary vats. The cleansed cotton is made soluble in alcohol by impregnation with nitric and sulphuric acids.

Centrifugal action removes excess acid from the nitrated product. After being immersed in water, the cotton is freed of all moisture by centrifugal wringers, operating at high speed.

In huge drums of two-ton capacity the cotton is sealed with a quantity of wood alcohol and rotated for several days. The solution which results has the consistency of extracted honey. Cleansed by a special process, this mixture is poured upon revolving polished wheels, where it becomes film of uniform thicknesses. A period of aging follows, and the film is ready for the emulsion which makes it photographically sensitive.

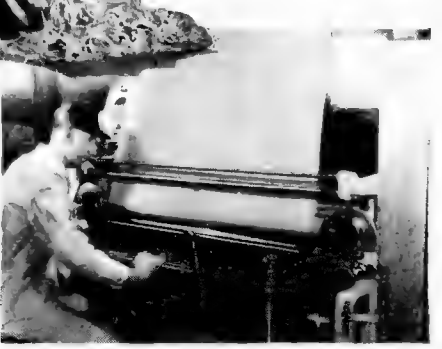
Silver bullion in 42-pound bars is dissolved in nitric acid to give the active element of the emulsion. In solution this (*Continued on page* 1127)

Cubes of optical glass are softened in a furnace and molded in a press. They emerge in tablet form, ready for annealing and grinding.



The polished eyes of the first film cameras looked out on many a gay and roguish group.

The engraving gives an idea of the equipment necessary for field photography in "wet-plate" days.



Shredded emulsion is heated until it liquefies and then is spread evenly by mechanical means upon broad sheets of basic film.

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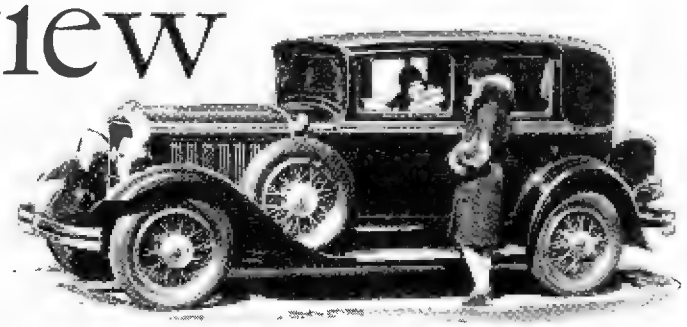
America's New Motors Pass *in* Review

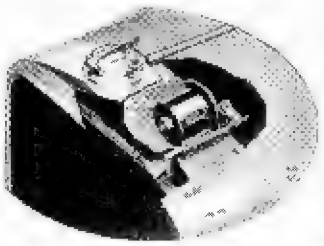
More Cylinders, European Body Types Characterize 1930 American Models

By Murray Godwin



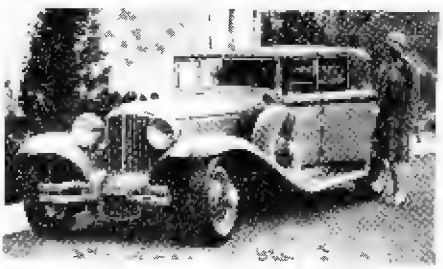
The trend of American cars toward Continental smartness is well exemplified in the Studebaker Dictator light brougham for four passengers and driver.

AMERICANS will drive fleeter, trimmer, more powerful cars from now on, a survey of the 1930 models shows. . . . And in large part they will be cars displaying a definite trend toward the European in body design. The American-style body of yesterday seems generally to have been cast aside as something that had stood about all the "refinement" that it could take. In some cases Continental ideas of motor body lines have met with all but complete acceptance, and it would be difficult to find a new American car which does not display some European feature or line.

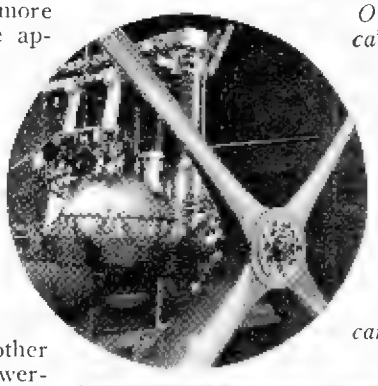


Radiator shutters with thermostatic control in the Studebaker President and Commander eights.

The movement toward more power has gone hand-in-hand with a movement toward smoother operation, and more often than not the result is made apparent in an increased number of cylinders. Several well-known makers, previously stressing six cylinders as the logically correct number for the medium-priced car, have gone into the eight-cylinder field in earnest. Among them are De Soto and Dodge. Leading the movement toward the ultimate number of cylinders, of course, is the Cadillac V-16, delivering twice as many power impulses per revolution to the crankshaft as any other current American automotive powerplant, and a third more than the Packard V-12, discontinued several years ago.

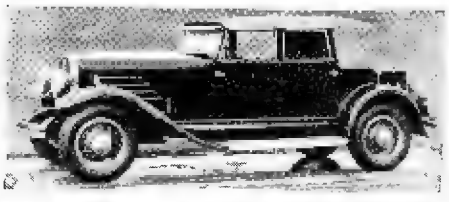


One of America's front-drive cars, the Cord, is shown above.

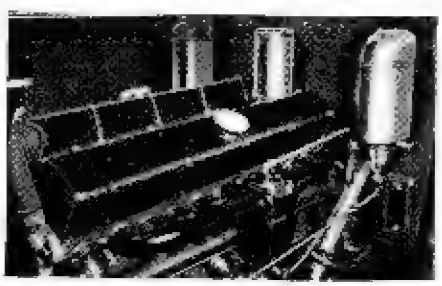


On the left is an airplane power plant incorporating the Elcar lever-motor principle.

More fundamental than the more-cylinders trend is the definite establishment of the front-wheel-driven car in the American automotive field. This form of drive, which has seen considerable use on the track but is comparatively unknown on the road, appears this year in the Ruxton, the Cord, and the Gardner. The first-named is the only product of the company's making; the latter two are additions to the already established lines of Auburn-Cord and Gardner. There are obvious advantages in front-wheel drive: the long propeller shaft, driving through two universal joints to the ring gear, is eliminated, and the elimination of the ring gear and its large housing permits the center of gravity to be lowered. It is interesting to note that front-wheel drive is actually the most ancient form as well as the most modern. Not only does it bring the motor car back to the horse-and-buggy principle, but to the principle of Nicholas J. Cugnot, who in 1769 or thereabouts built a tri-wheeled motor carriage in which traction and steering were both accomplished through the single front wheel.



The new Franklin is powered by an airplane type motor, like all the new Franklin line.



The Cadillac 16-cylinder engine is thoroughly enclosed. A double dash conceals all piping and wiring.

Front-wheel drive and steering were also applied to motor cabs in Paris in the late 'nineties, and front-wheel drive with rear-wheel steering to electric cabs in New York. Front-wheel drive in its modern form has been a feature of several European cars for a number of years. It is apparent, therefore, that it is a practicable method of gaining traction, if rightly applied.

Even more fundamental than front-wheel drive is the unique lever motor now used in the Elcar. Here, for the first time in many years, appears a practicable change in the basic mechanism of the internal combustion motor itself. A lever is introduced between the end of the connecting rod and the crankshaft, which is turned by a second rod, extremely short, connected with the lever at dead center. The lever action multiplies the power by two between piston and crankshaft—that is the first advantage of this application of the Archimedean principle. But it is not the only one by any means. The length of stroke permissible is greatly increased, for the connecting rod proper has only a trifling non-vertical play, hence a bore-to-stroke relation of 3″—8″ is made practical. Eccentric cylinder wear is practically eliminated, and power is more efficiently applied. The long stroke gives more time for combustion. (*Continued on page* 1130)

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Insulation—a *for* All

Loose insulating material is being blown into hollows in the walls of this Fort Wayne home. The process does no harm to the finish and is thoroughly effective. (Johns-Manville.)

From Summer Sun and Protects You and Your Second of a Series, Mr. of the Home

By S. Gordon

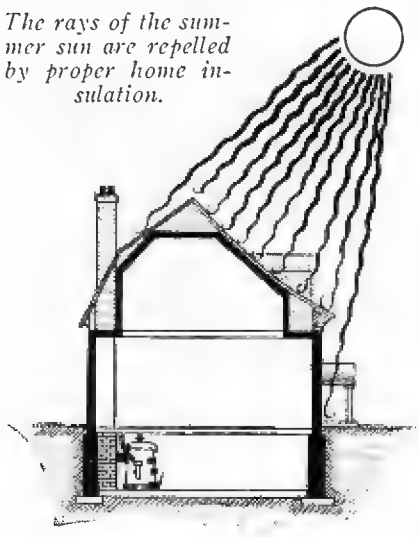
HAVE you regarded home insulation as a subject for Fall? . . . It's a mistake. There's no better season for thinking about insulation than right now—and no better time, either, for carrying out the insulation plan your home needs.

It's true that insulation keeps winter furnace heat inside the house where it belongs. The Bureau of Standards has stated that it saves from twenty to forty percent of the fuel bill—the exact figure depending on the types of wall construction and insulating material employed. . . . But insulation serves also to repel the heat rays that in summer beat upon the roof of your home. The insulated house is actually cooler in summer as well as warmer in winter. And insulation therefore is a fit subject for any season—and a paying investment in the bargain. For in fuel economy alone it pays for itself within a few years after it has been installed.

Top floor ceilings are readily insulated with fillings of rock wool. (Johns-Manville.)

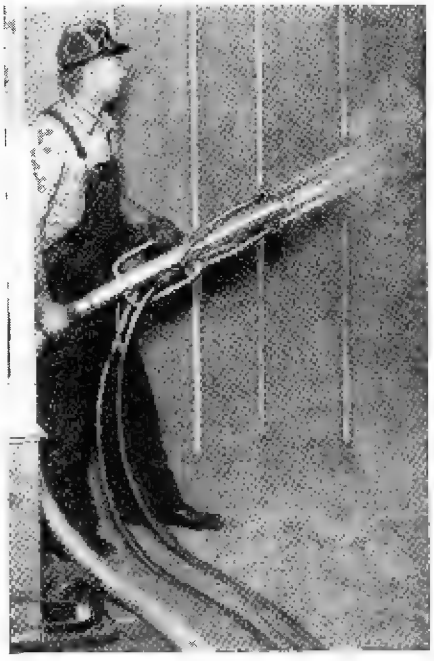
An existing house can be thoroughly insulated by methods recently developed for blowing insulating materials into the hollow spaces in the walls. This process adds somewhat to the expense, of course, but not enough to make the plan impractical by any means. In following this method the work is usually done from the outside and does not damage plaster or decorations in any way, nor need it deface the exterior of the house.

The rays of the summer sun are repelled by proper home insulation.



For those who are planning new homes for erection this summer, now is the time to study the possibilities offered by insulation. Not only is insulation readily installed during construction, but if the new home is well insulated in side walls and roof the heat requirements will be less and a smaller heating system with much smaller radiation capacity will be adequate. Moreover, in constructing a home it is sometimes possible to replace some of the common structural materials with insulating materials which will serve equally well from the structural point of view, and will provide insulating value in addition. Unless strictest economy is essential however, it is best to add insulation to the other structural materials. In this way the superior insulating qualities of the insulating material are added to the inherent insulating value of the other structural materials in the walls, and thus maximum insulating efficiency is provided.

In discussing insulation for the home, it is convenient to consider it from the standpoint of winter conditions. Its direct benefits are more tangible at that time, in that they are reflected in a dollars and cents saving in fuel. Moreover, insulation that is effective in winter will be effective in summer, for the simple reason that insulation which prevents the escape of heat from the house to the outside in winter will prevent the summer heat from



Blown-on insulation hardens, forming a coat. (Sprayo-Flake Company.)

List of Manufacturers' Literature Announced

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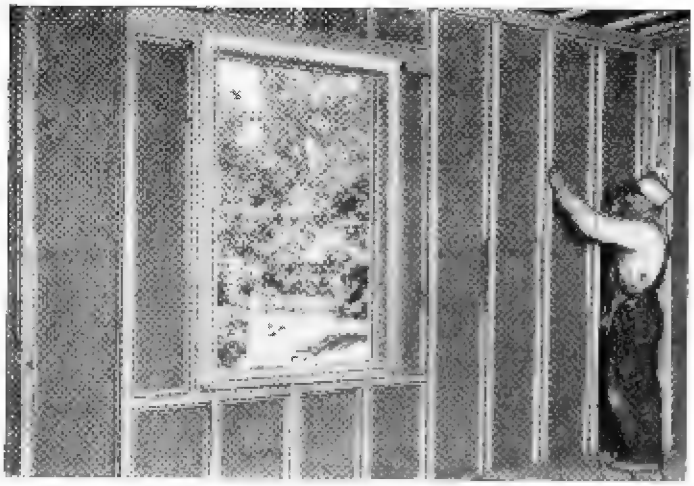
Paying Investment Seasons

Winter Cold Good Insulation Family. In This Article, the Taylor Makes a Pointed Survey Insulating Field.

Taylor



Many householders are able to perform this simple and efficient insulating job. (Flax-Li-Num Insulating Company.)

entering through roof and walls.

Assuming that a house is to be insulated, several questions arise as to what insulating materials should be used, where it should be installed, and what will be its effect.

First of all, the purpose of insulation is to retard the transmission of heat. To a certain extent practically all materials that go into the walls or roof of a house provide some degree of insulation. The insulating value of any material is determined by its ability to conduct heat. Lumber one inch thick will conduct heat four times as readily as a good insulating material of the same thickness. Therefore, a one-inch thickness of this insulating material is equal in its insulation value to lumber four inches thick, a brick wall 20 inches thick, concrete 33 inches thick, stone 72 inches thick, or plaster 13 inches thick.

An insulating quilt of balsam wool is easily installed. (Wood Conversion Company.)

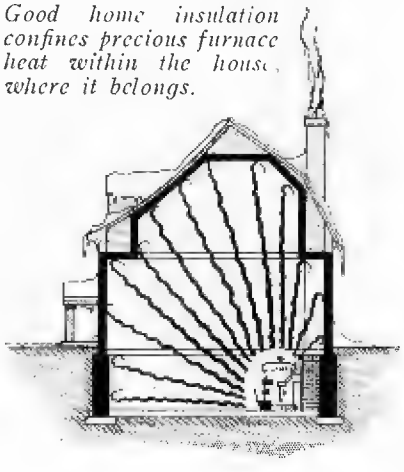
Flexible insulation between studs adds to home comfort. (Flax-Li-Num Company.)

Dead air spaces in walls are good insulators also. Thus, the heat-retarding value of the wall of a frame house is greater than the sum of the retarding values of the materials which make it up because there is a dead air space between the exterior and interior surfaces. But, by adding insulation to this wall, its total insulation value may be practically doubled, which means that only half as much heat can pass through it as through the uninsulated wall. In some wall construction, the addition of insulation may show an even greater improvement than this.

Insulation in the walls and roof is not the only preventive of heat loss in winter. The infiltration of cold air around doors and windows and the comparatively high conductivity of glass windows are important contributions. The Bureau of Standards Circular C-376 (a copy of which can be obtained for five cents from the Bureau at Washington, D. C.) shows that a fuel saving up to 40% can be made by provision of insulation in all exterior walls and roof. Weather-stripping to minimize cold and infiltration, and storm windows to reduce heat losses through the glass, will bring about additional fuel savings which, with insulation, bring the total fuel consumption down to approximately 40% of the amount which would be required to heat the same house without these improvements. From these figures it is evident that proper insulation is the most important factor in eliminating heat losses. Weather-stripping and storm windows have about equal value as to heat savers and both together are about half as effective as good insulation in walls and roof.

Insulation of the top of the livable portion of the house is of the greatest importance. It is here that the heat loses are greatest in winter and it is here that the heat enters most readily in the summer because of the direct exposure of the roof to the beating sun. The insulation may be placed in the roof (*Con'd on pg.* 1130)

Good home insulation confines precious furnace heat within the house, where it belongs.



in March Issue Will Be Found on Page 1147

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Help Your Trees Get *their* Vitamines

By Evelyn Smith

President, Amawalk Nursery

Out of Her 20 Years' Experience in Developing the Largest Big-Tree Nursery in the World Miss Smith Instructs the Amateur in Spring Trimming.

The field grown elm may be safely cleared of dead branches and cross limbs at almost any season of the year.

THE average householder gets an attack of tree-trimming fever in its most virulent form early in the spring. If the sun and the pruning shears are simultaneously bright and shining, only definite self-control is going to prevent him from getting right out to trim something. Unless he curbs this fever by the application of definite tree knowledge, he may do incalculable damage to his helpless trees.

It is almost a pity that the average man believes himself to be at heart a naturalist, merely because of this yearning to get out into the sunshine. For every time he cuts off a branch of a tree under the delusion that he is benefiting it, he is likely to rob the tree of a certain amount of digestive food greatly needed by the roots.

Keep in mind the fact that every tree is a complete unit in itself, with each leaf a manufacturing plant. Without a goodly crop of leaves, the roots must perish, for they take in crude water from the soil, send it up into the tree through the sap wood, out into the branches into the leaves, where with the aid of the sun and the chlorophyl, it brings about the production of digested sap or carbohydrates (sugar and starch). From here it flows to the cambium layer and is distributed over all parts of the tree. Disturb the balance of this process by ruthlessly depriving it of the branches and you disturb the balance of the entire tree.

Basically the reason for spring trimming is that the branches can be seen more easily before the foliage is out, and the true shape of the tree determined. The small householder should study his trees well before allowing the pruning shears to make their first snip. He should be acquainted with the family characteristics of the tree and not attempt to make a white pine resemble a cedar in shape nor a Douglas fir grow like an arbor vitae. Destroying these family characteristics will destroy the beauty value as well as the lumber and commercial value of the tree.

All dead branches and cross limbs may be safely cleared out in the spring, taking care to do this in the early spring, when growth is dormant, rather than later when foliage is ready to burst forth after a day or two of sunshiny warmth. Maples, however, should be trimmed in late spring, to prevent bleeding of the sap. Oaks, elms, locusts, copper beeches and other ornamental trees may be trimmed at almost any season of the year without undue injury to the tree.

Fruit trees, on the other hand, are usually trimmed in the winter, partly for the reason that farmers and fruit growers have more leisure at this time. The scientific fruit grower, however, is coming more and more to do some summer pruning and to determine the size of his next year's crops by the production of the current year. He has learned how to thin and trim the trees and to know to an apple or a peach just what his trees can stand in the way of production without weakening themselves.

And mark the difference between pruning, trimming and shearing. Pruning, cutting away dead limbs and the cross branches that show up so clearly in the spring, may be done easily enough by the amateur if he does not permit his pruning shears to become too reckless in cutting extravagance.

A light trimming of the tops to preserve the symmetry may also be done by the tree owner in the spring, providing he has an eye to balance and knows the family characteristics of the tree.

Shearing is (*Continued on page* 1140)

Late Spring trimming prevents the bleeding of sap in this nursery-grown avenue of maples at Evelyn Smith's Amawalk Nursery, Amawalk, N. Y.

Evergreens, sheared in accordance with their natural form, possess heightened beauty.

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Once He Made Steam Automobiles Now—Violins

Successful in Business, Freelan O. Stanley Occupies Himself Wholly with His Chosen Art

By William T. Miller

Mr. Stanley is never so happy as when at work on one of his violins.

INVENTOR, promoter and manufacturer by vocation, but by avocation a maker of fine violins—this is the combination which makes the story of Freelan Oscar Stanley one of unusual interest. Few people have been able so happily to balance work and play.

Much is known of Mr. Stanley's steam automobiles, photographic dry plates and X-ray research: but little is known of his violins. Yet the diligence that he has devoted to their making has matched his efforts in the business and professional worlds. In fact, long before dreams of industrial conquest had taken root in his brain, he had conceived and built his first violin.

At the age of ten Mr. Stanley made a child's sized instrument with his own hands, and then, with painstaking thoroughness, taught himself to play. When he was sixteen years old he made two violins, each showing excellent workmanship. One of these he sold for ten dollars—the other he has always kept.

Scion of "Down East Yankee" stock, Freelan O. Stanley and his twin brother, Francis E., were born in Kingsfield, Maine, June 1, 1849. Both attended the Farmington State Normal School after early training in the rural schools. For several years Mr. Stanley was principal of the high school in Columbia, Pennsylvania.

Even as a school teacher his passion for craftsmanship asserted itself. During his spare time he made several violins, which were so admired and commanded such a price in comparison with the salary he was drawing that he was tempted to make a business of his violins. And although he did enter another business after several years of teaching, the art of violin-making remained his cherished hobby. He returned to his native state of Maine and in the little town of Mechanics Falls began the manufacture of drawing instruments.

Meanwhile, his brother, Francis, had become the leading photographer in Lewiston, Maine, and for his own use had developed a special process photographic dry plate. The destruction by fire of Freelan Stanley's factory in Mechanics Falls brought the brothers together in business. In the early '80's they started manufacturing the Stanley dry plate, and in 1890 they moved their plant to Watertown, Massachusetts. During the next few years, Freelan Stanley spent much time in his laboratory. Notable among his achievements was the focusing of the X-ray, a discovery which made possible practical surgical photography. He organized a company which produced a complete X-ray outfit selling at $50.

Years ago, with his brother Francis, Mr. Stanley built his first successful steam car.

Later Freelan Stanley and his brother, ever alert to scientific progress, began to experiment with the "horseless carriage." Their first machine was built in the Orient Bicycle Company factory in Waltham and was powered with a two-cylinder double-action steam engine. Their daily experimental trips through the suburban streets in this vehicle brought orders for twenty-five machines before production was started in the Sterling-Elliott plant (where hickory wood bicycles were made). This was next door to the Stanley Photographic plant.

A group of New York capitalists saw the possibilities in the young industry, and headed by J. Brisbane Walker, then editor of the *Cosmopolitan Magazine*, took over the Stanley process and started manufacturing cars in Bridgeport, Connecticut, founding the Locomobile Company of America. The arrangements permitted the Stanley brothers to start manufacturing again after a two-year recess. So in 1902 they built a larger factory in Watertown and began to manufacture a steam-driven automobile—one of the outstanding machines of its type in the world. Freelan Stanley personally drove one of his cars to the summit of Mount Washington—the first man to make the trip in an automobile.

In 1904, Eastman bought the patents and processes for the Stanley dry plate, and during the next dozen years the Stanley brothers devoted themselves to the development of their automobile interests.

After the accidental death

(*Continued on page* 1129)

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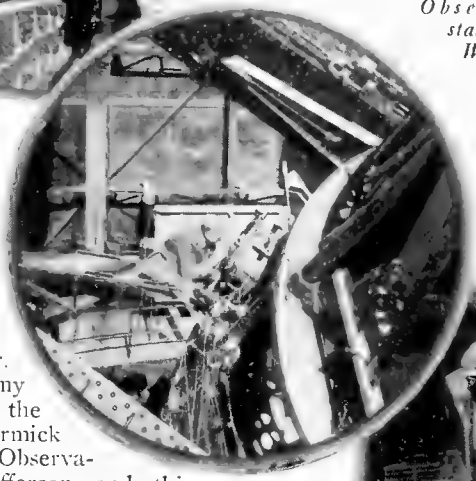
The Marvelous

Telescopes Enable Astronomers to

By Joseph

Ewing Galloway

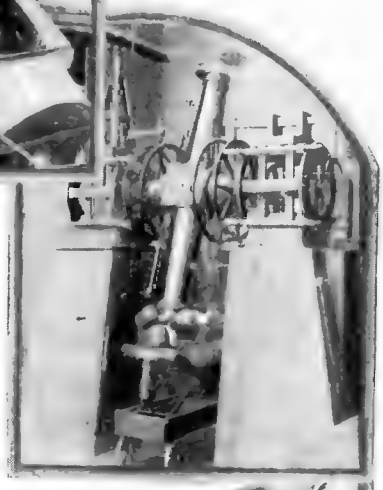
Exterior view of the Mt. Wilson Observatory, which contains a 100-inch reflector.



Observing the stars in the Mt. Wilson Observatory.

Did you know that there are two kinds of telescopes—refracting and reflecting? In the first, light passes through a lens which converges the rays to a focus where the image is magnified by a second lens or group of lenses called the eye-piece. In the second, a large concave mirror of glass coated with silver throws the rays back toward the upper end of the telescope, where they fall on the eye-piece.

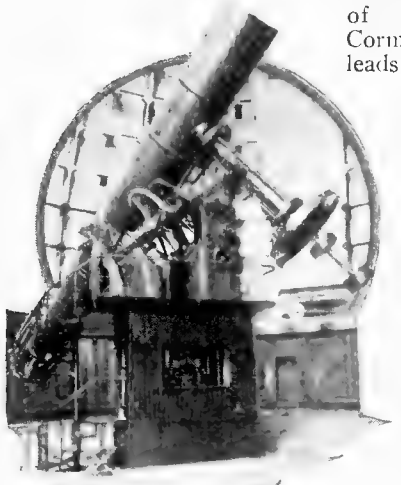
The present world's largest telescope, a 100-inch reflector at Carnegie Institution, Mt. Wilson, California. Below: The most accurate time-piece in the world, where observations are made through a 6-inch transit circle—Naval Observatory, Washington.



DR. SAMUEL ALFRED MITCHELL was recently honored for his announcement that he had completed measuring the distance to 1000 stars. Dr. Mitchell is Professor of Astronomy at the University of Virginia and the director of the Leander McCormick Observatory. The McCormick Observatory is on top of Mt. Jefferson and this announcement, coming from the famous astronomer, is a great contribution to the science of astronomy. The McCormick Observatory thus leads the world in measuring distances to the stars by the parallax method and is 100 ahead of its nearest competitor, the University of Pittsburgh.

In measuring the distances to stars, there is only one direct way of performing the work. This is known as the trigonometric method and consists in taking photographs of the same star from opposite ends of the orbit of the earth as it moves around the sun. This gives the astronomer a known base line from which he can compute the stellar distances. It takes about half an hour to expose the photographic plate. After this has been done with about 20 plates for the same star, the parallax is measured.

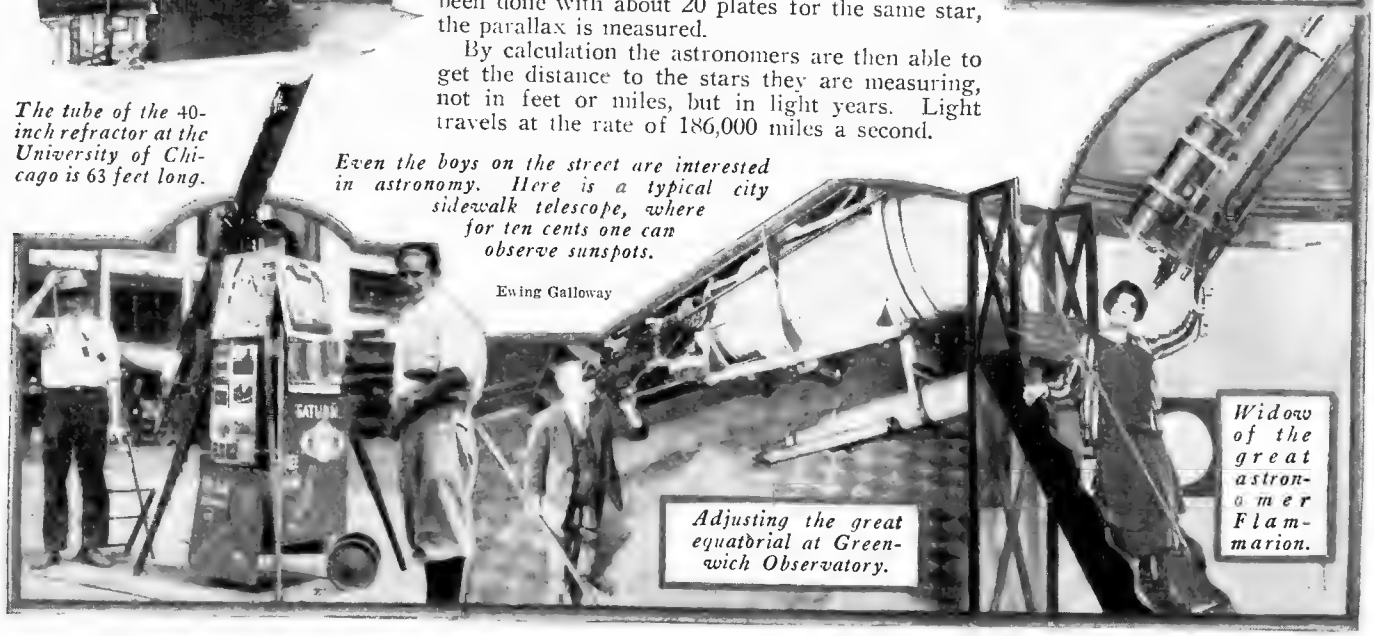
By calculation the astronomers are then able to get the distance to the stars they are measuring, not in feet or miles, but in light years. Light travels at the rate of 186,000 miles a second.



The tube of the 40-inch refractor at the University of Chicago is 63 feet long.

Even the boys on the street are interested in astronomy. Here is a typical city sidewalk telescope, where for ten cents one can observe sunspots.

Ewing Galloway



Adjusting the great equatorial at Greenwich Observatory.

Widow of the great astronomer Flammarion.

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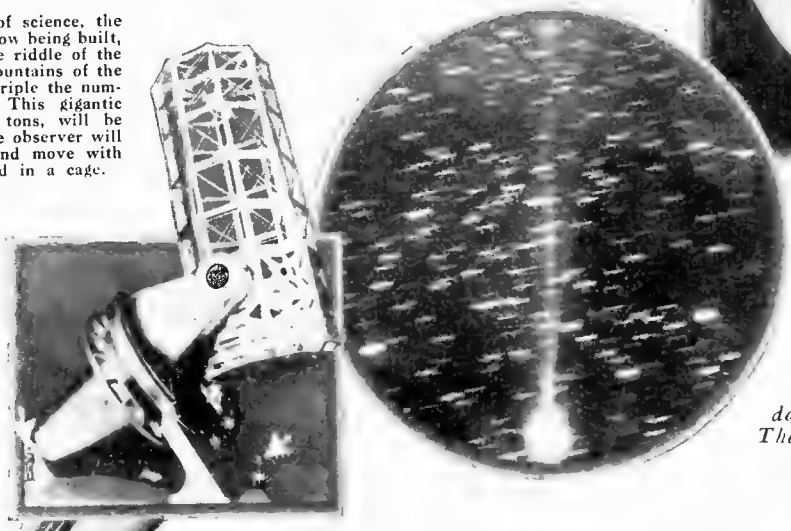
Eyes *of* Science

Measure Distance to 1,000 Stars

H. Kraus

With the newest "eye" of science, the world's greatest telescope now being built, we may expect to solve the riddle of the canals on Mars and the mountains of the moon, and will be able to triple the number of observable stars. This gigantic telescope, weighing 1,600 tons, will be balanced like a watch. The observer will sit inside the structure, and move with the instrument, like a bird in a cage.

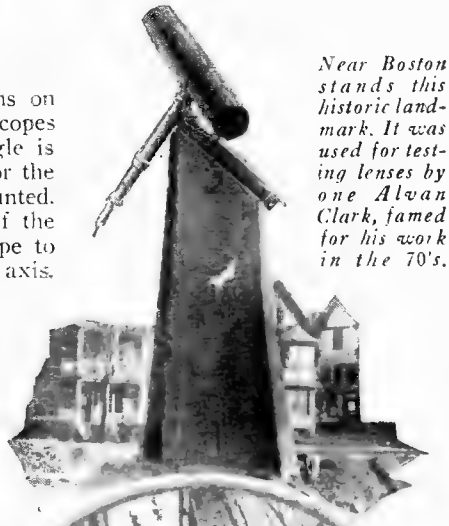
An interesting photograph of the moon. The new telescope will enable us to see moon areas as small as a city block.



The huge new world's telescope now under construction. Arrows point to men shown for comparison. Below, a board fastened to the end of the telescope to record spots of the sun. This is how Father Ricard, of Santa Clara, California, called the "Padre of the Rains," gets his information.

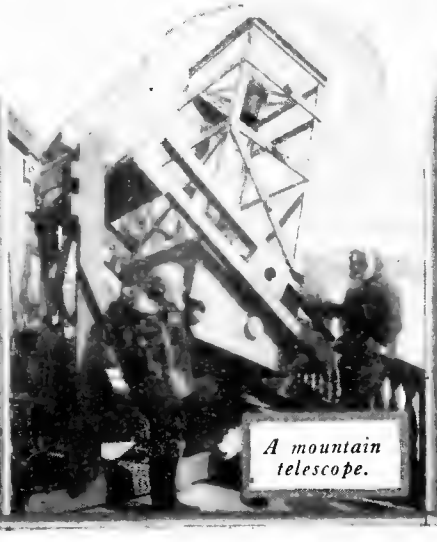
A wanderer of the skies, the comet Wilk. The central beam of this comet is at least a million miles long. The white dashes across the picture are stars. The photograph was taken at the Yerkes Observatory.

IF the reader will look at the illustrations on this page, he will note that all of the telescopes are mounted at a peculiar angle. This angle is called the equatorial, and is predetermined for the position where the telescope is to be mounted. The angle is exactly equal to the latitude of the observer's location. This causes the telescope to be mounted exactly parallel to the earth's axis, and enables the observer to follow the path of any heavenly body with remarkable precision, and without the necessity of manipulating too many controls. In the new gigantic telescope, with a mass of 1,600 tons, the astronomer located in the instrument itself, moves with the telescope. He need merely press a button to swing the entire structure noiselessly back and forth. The cost of the new telescope at Mt. Wilson is estimated at $12,000,000.



Near Boston stands this historic landmark. It was used for testing lenses by one Alvan Clark, famed for his work in the 70's.

The Perkins telescope.



A mountain telescope.

Scene in Lick Observatory.

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A Great Lake City

and Its Applied Science

Milwaukee from the air. In the foreground stands an efficient sewage disposal plant, which produces 100 tons of fertilizer daily.

At Wisconsin avenue a bridge raises to permit sizable lake freighters to pass up the Milwaukee River through the heart of the city.

MILWAUKEE has acquired ownership of all the lake frontage within its limits—a great advantage from the standpoint of both scientific development and beauty. One especially modern example of the former: Milwaukee's Maitland Field, an airport municipally owned and operated, is situated on the lake shore only ten blocks from the postoffice and Federal building, instead of in the wilds, as might have been the case had the lake front been in many private hands. . . . Another example—Milwaukee's harbor facilities are developed as and where needed, without the necessity of condemnation and purchase. On the beauty side: Milwaukee devotes all lake shore not needed for commerce to parks, recreation fields, and motor drives.

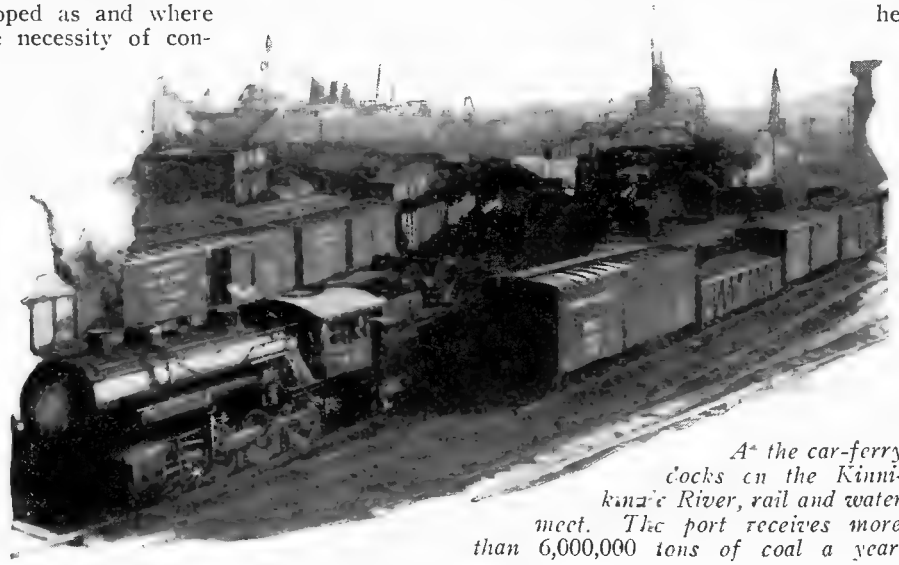
Within easy motoring distance Milwaukee has three other airports, one owned by the county, one by the Holterhoff Flying Service, and one by Curtiss Flying Service, Inc. . . . Five steam roads, two car ferry systems, bus lines, and local and interurban electric lines serve the city's ordinary transportation needs. Nearly 150,000 motor vehicles were registered in the county during last year, and for 1930 the total is likely to be larger.

Generally as well as in its lake shore development Milwaukee is carrying out seriously the task of scientific city planning, and has received much attention from students of municipal affairs on this score. Nor does science stop at the city hall door: Milwaukee has established an amortization fund to wipe out municipal indebtedness, and the efficiency of its civic activities is shown by its high credit rating and its extremely low insurance rates, as also the admittedly high grade of its educational facilities.

Lincoln Memorial Bridge connects Juneau Park with a lake shore drive. Between the bridge and the water are public athletic fields.

Milwaukee's industry scores in both variety and magnitude. . . . It is among the greatest heavy machine construction centers of the world. It builds the largest steam and water turbines for electrical generation. It has produced the largest hydro-electric unit ever attempted. It rates high in the manufacture of flour milling machinery, steam shovels, dredges, cranes and hoists, refrigerating equipment, concrete mixers, tractors, saw-milling

(*Continued on page* 1149)



At the car-ferry docks on the Kinnikinnic River, rail and water meet. The port receives more than 6,000,000 tons of coal a year.

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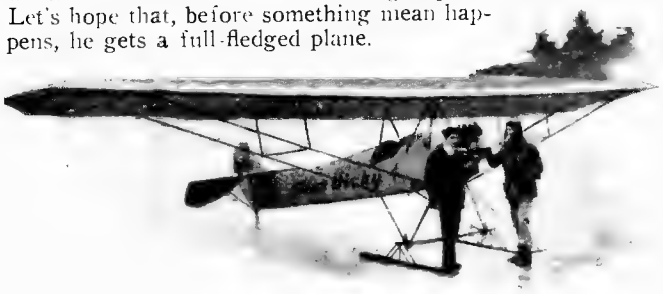
In the Spotlight of Science

Red Nose Gives High Sign

WHEN you make an after-dark call at the Milwaukee county airport, a red-nosed high sign tells you that you've arrived. . . . The county has made an installation there of a Zepp-shaped wind cone which serves the double purpose of indicating the field and giving the night flyer the lowdown on the direction of the breeze. The tail of this interesting indicator is white, and the nose, as hinted, is red. Naturally, the cone is illuminated.

Scrapheap Becomes Snowbird

STOVE BOLTS and door hinges were the unapproved aids with which Leo Tremblay of Concord, New Hampshire, assembled a plane of his own design. For a power-plant he used a motorcycle engine, and when the job—a parasol monoplane—was finished he mounted it on skis, so that he could take off and land with it on the ice. . . . Concord airport officials admired Leo's achievement to the extent of offering to defray for him the cost of a flying course which would make him a full-fledged pilot. Let's hope that, before something mean happens, he gets a full-fledged plane.



Thumbs Down on Daydreams!

"SHY and sensitive individuals with a feeling of inferiority very frequently are a type which later break down with dementia praecox," says Dr. K. M. Bowman, who has conducted a four-year study of the subject in the Boston Psychopathic Hospital. According to Dr. Bowman's conclusions, persons who cannot cope with the practical world learn to take refuge in fantastic worlds of their own. The ultimate result is loss of contact with the world of fact.

Just Charge It at the Soda Fountain

THE flexibility of the rocket car idea got a new extension when Dr. Max Valier, German experimenter, fueled up with two tanks of carbonic acid and took his latest vehicle down the road at 90 kilometers an hour. . . . Previous experiments by Herr Fritz von Opel, also a German, had been carried out with rockets charged with explosive—in the ordinary sense of the word. Later, Herr von Opel, following Dr. Robert Goddard, proposed the use of a liquid propellant, expanded by combustion. Dr. Valier's departure into the field of the non-combustible expanding liquid propellant opens up the interesting possibility of a soda fountain and motor filling station in one. However, it is not an advance but a step backward to the day when hordes of inventors entered the automotive ring with cars propelled by compressed air—all of them quite impractical.

Not Einstein! He'd Blow a Tube!

AT last we're on our way to detecting brain static, if not to eliminating it. Dr. Milton Mettessel, renowned specialist in speech defects, has made practically perfect a light- or sound-wave mechanism through which cerebral impulses register in the form of photographic designs or amplified sound, depending on the method employed. . . Contact is made with the tongue of the subject, which offers a sensitive area for the detection of impulses that otherwise would go unnoticed. So now those persons we dislike may have a chance to discover where that rattle comes from . . . or that roaring sound.

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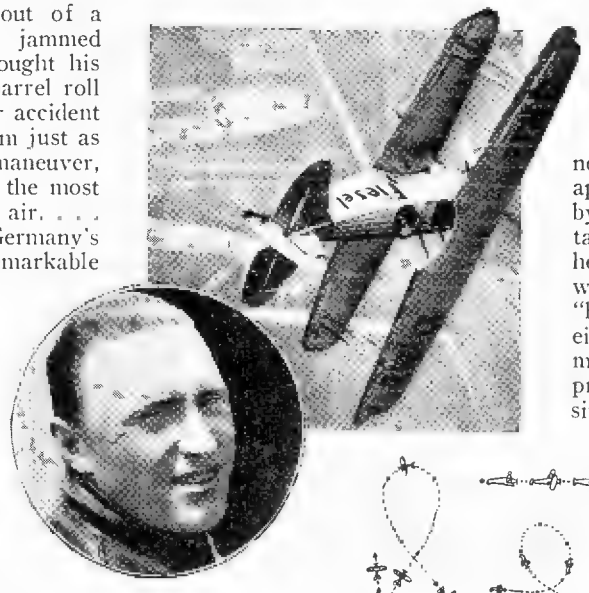
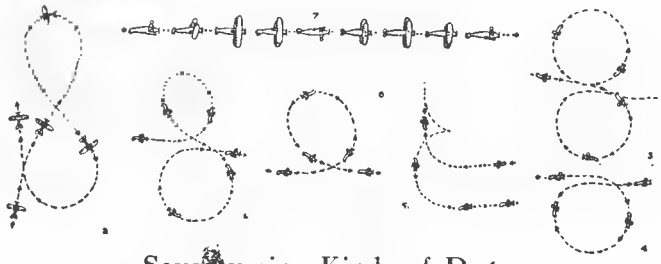
Champion Flyer Cuts Scroll-Saw Figures in the Sky

AFTER tailspinning 3000 out of a possible 4000 feet with jammed controls, Gerhard Fieseler brought his plane out of it by making a barrel roll with an inverted loop. . . . By accident or intent the camera caught him just as he performed this aerobatic maneuver, and the picture was hailed as the most remarkable ever made in the air. . . . Fieseler is looked on as Germany's finest flyer. In 1929 his remarkable ability won him a medal. In the line drawing are diagrammed figures first flown by him: 1, is an inverted vertical eight; 2, an inverted horizontal eight; 3, a vertical eight; 4, an inverted outside downward loop; 5, a tailslide ending in a half outside downward loop; 6, an inverted upward outside loop; 7, an outside barrel roll. . . . We



Americans have seen plenty of sky-writing, but Pilot Fieseler undoubtedly could show us several new wrinkles in the art. He seems a veritable scroll-saw craftsman of the air. . . . "Wrinkles," you will note, is no exaggerated term when it is applied to the art of stunting as practiced by Gerhard Fieseler. In Figure 5—the tailslide ending in a half-outside loop, he actually does describe an aerial wrinkle, and comes out of it to take a "header" toward the earth. The vertical eight stunt contains no wrinkles, but it makes up for that with its sweeping and precarious curves. Outside loops are simply meat and drink for the German.



But You Can't Convince a Soprano

IOWA UNIVERSITY makes a bid for new fame for that state by giving to the world the tonascope. When you sing into the horn of this admirable contraption, it registers in graph form the characteristics of your vocal effort. . . . If there are imperfections that can be ironed out, the record guides you in correcting them; and if your effort is simply one big imperfection, it offers you written evidence to that effect. The trouble is that tone-deaf sopranos will invariably be convinced that the neighbors have tampered with the machine. . . . The tonascope should prove an admirable complement to the Metfessel machine for recording the state of one's mind (see previous page). Mental and vocal harmony might be had together.

Seventy-nine Kinds of Dogs

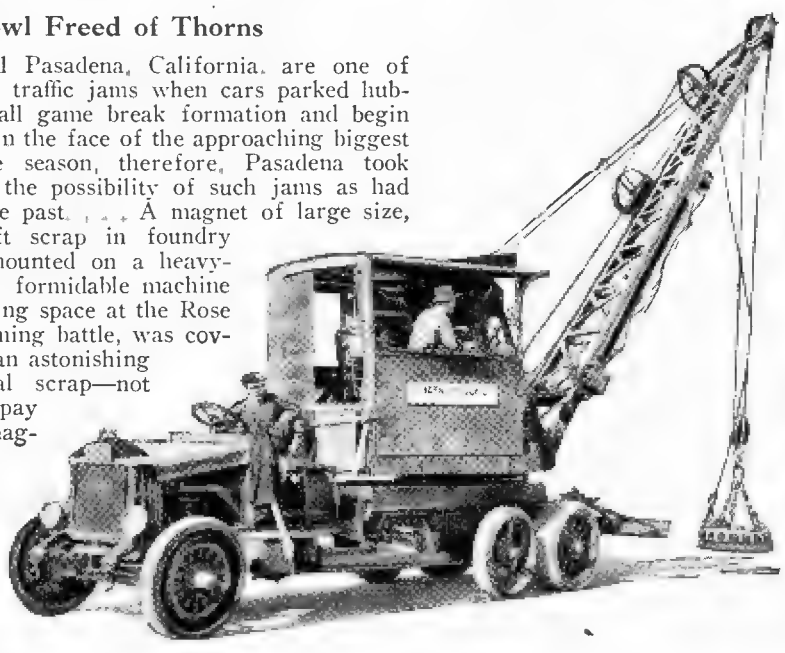
SCIENTISTS in ages to come will be able to view seventy-nine varieties of dogs, as of 1930, when Yale completes the canine museum it has planned. The finest of each distinct breed will be represented, in both skeleton and mounted form. . . . Among those now present are the Black and Tan, Newfoundland and Irish Wolfhounds, Cocker Spaniels, Bulldogs, and Bloodhounds.

Sodom Uncovered

THE ruins of the ancient and notorious city of Sodom are believed to have been uncovered by an expedition sent into Transjordania by the Pontifical Biblical Institute. Excavations show several tiers of ruins, indicating that the city was destroyed twice. . . . The main section of the city is about 1,965 feet long and 1,310 feet wide. The houses are in a fair state of preservation, and a vast amount of pottery, small animal figures, and bone implements and jewelry has been found in them. Ditches filled with ashes are thought to have been crematoriums. The character of the findings seems to date the city as belonging to the first bronge age. . . . The theory is that the original inhabitants of the city came from Mesopotamia. Sodom once formed one of the five famous cities of Pentapolis, existing before Abraham's time.

Rose Bowl Freed of Thorns

FLAT tires, decided Pasadena, California, are one of the chief causes of traffic jams when cars parked hub-to-hub during a football game break formation and begin to roll toward home. In the face of the approaching biggest football event of the season, therefore, Pasadena took measures to eliminate the possibility of such jams as had marred big days in the past. . . . A magnet of large size, like those which shift scrap in foundry yards, was secured, mounted on a heavy-duty truck. With this formidable machine every inch of the parking space at the Rose Bowl, scene of the coming battle, was covered. The result was an astonishing accumulation of metal scrap—not enough, probably, to pay the cost of truck and magnet operation, but enough to bring about a vast reduction in the number of tires punctured and the consequent delays in clearing the field of cars.



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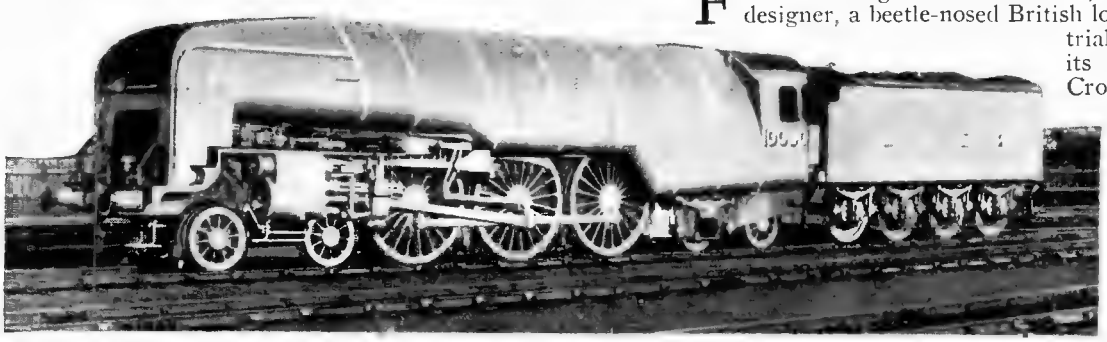
A Living World of Toys

LADISLAS STAREVITCH, Polish film producer, probably has carried the art of toy animation as near to perfection as it will ever get. . . . In the Starevitch film plays, tiny figures, executed with masterly realism, perform impossible feats with extraordinarily convincing effect. The Starevitch casts include animals, imaginary figures, and types taken from life. One of this director's achievements was the production of an entire mediæval talkie satire with toys playing all the rôles. . . . Though Starevitch's complex performances are beyond the reach of the amateur, the home movie maker can achieve interesting results by following the lines suggested by Don Bennett in the March number.

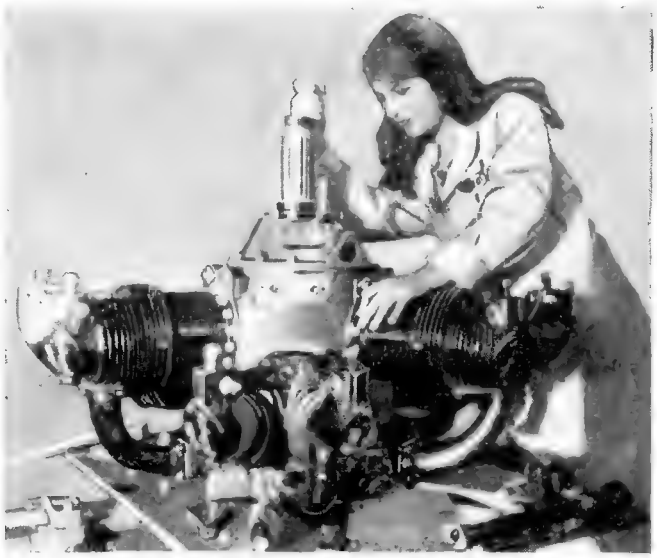
Under Cover

FOLDING rainguards for theater patrons are being distributed free in wet weather by a theater group in New York. The new "umbies"—as some unidentified person has called them—have no ribs, can be carried easily under the arm. . . . And if you leave one somewhere it will be only a paper loss. That alone will amount to a considerable advantage for the average umbrella user.



She Knows Her Engines

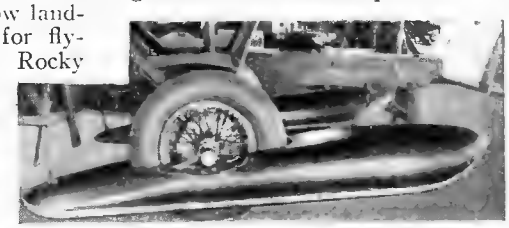
PRETTO BELL is the name of the country's youngest aviation student, enrolled at the age of twelve in the Curtiss Flying Service school at Los Angeles. Department of Commerce will not permit Miss Bell to fly until she is fourteen, nor will they grant her a license until she completes her sixteenth year. Nonetheless, she is preparing for the future by intensive work both aloft and on the ground, and her instructors say she will be able soon to handle a plane safely. . . . Miss Bell's bright prospects are typical of those of the very youthful element in aviation throughout the country. Especially in the glider field the progress made by youngsters is amazing. A glider school conducted on the east coast last summer reports that American youth, from seven to fourteen years old inclusive, show a uniform



gift for learning how to manage gliders of the primary and secondary type. And many of them display unmistakable evidence of future proficiency in the power flying field. The next generation to a large extent will be a generation of pilots.

Slotted Skis for Mail Planes

PONTOON-LIKE skis, slotted to permit an airplane's wheels to reach through them, have been produced to make deep-snow landings possible for flyers on the Rocky Mountain mail route. The skis are claimed to absorb the landing shock of planes weighing 8¾ tons. . . . Only one possibility now remains to be probed in the landing gear line—that is the three-way combination of skis, pontoons, and wheels. A puzzling combination to name!



Hidden in the Milk Yard

FASTEST engine in the world, in the opinion of its designer, a beetle-nosed British locomotive made its first trial trip at night, and at its destination, King's Cross station, was hidden in the milk yard for an inspection by chiefs of the London and Northeastern Railway. . . . The big locomotive is hooded like a gigantic racing car and is extremely powerful and heavy.

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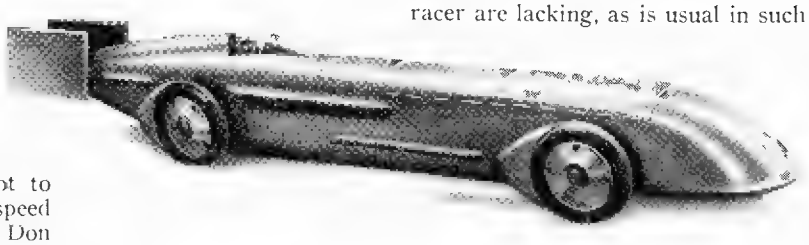
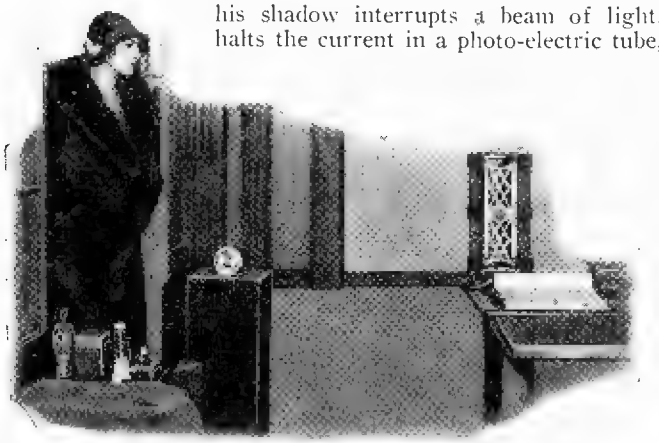
New Sunbeam Will Burn Up Sand at Daytona



SIR HENRY SEGRAVE'S Golden Arrow has a worthy appearing successor in the new Sunbeam built for Kay Don, who will use the car in an attempt to surpass the present land speed record. . . . Details of the Don racer are lacking, as is usual in such cases, but it is apparent that streamlining has been carried out in the design to a degree somewhat beyond any previous attempt in this direction. The designer is Louis Coatalen.

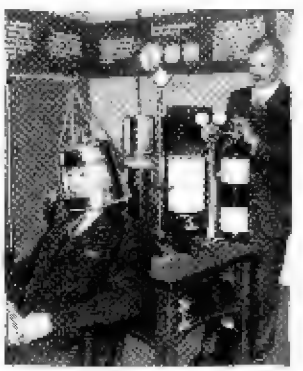
Automatic Welcome

THE visitor's welcome at New York's Museum of Peaceful Arts no longer depends for its cheeriness on the mood of a man. As the visitor enters, his shadow interrupts a beam of light, halts the current in a photo-electric tube,



and evokes from a sentinel "thyraton" a jovial greeting. Changing a record equips the thyraton to serve as a watchman, policeman, or even salesman. . . . The actual effect of the light interruption is to change the voltage of the thyraton, and start a synchronous motor. A contractor wheel attached to the motor shaft controls a phonographic record, which automatically stops when the word of greeting —or thanks, or warning—has been completed. According to the Automatic Merchandising Corporation, developer of the new device, the thyraton is to find wide use in conjunction with the delivery of wares from slot machines of the robot type, in the retailing of branded and packaged articles.

What's Your Thermal Efficiency?



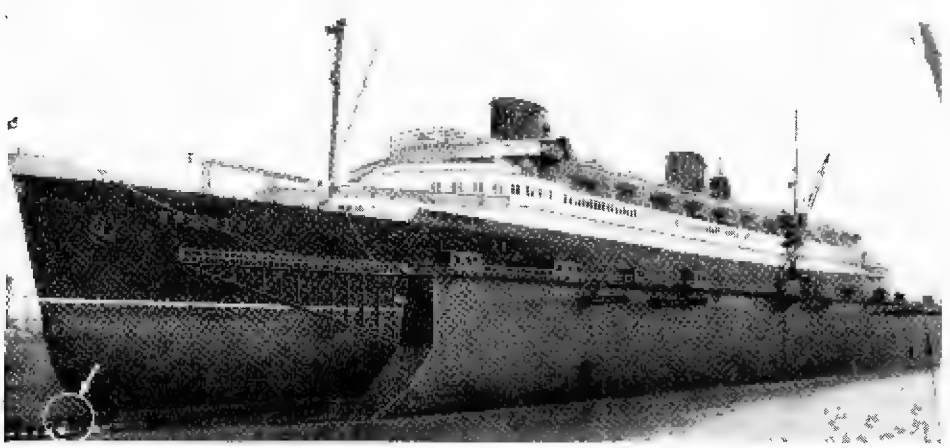
EXHIBITED at the Carnegie Institute at Washington was an apparatus for testing the heat-producing power of the human body and securing general data on the physical condition of patients. . . . The patient's head is encased in a steel and glass helmet, connected with a known quantity of oxygen. The amount of gas consumed has a direct relation to the amount of heat produced by the patient. Equipment now in existence provides means of determining with practical accuracy the efficacy with which nearly every physical process is carried on. With one device produced by Science the efficiency of the patient's metabolic powers can be indexed within very fine limits.

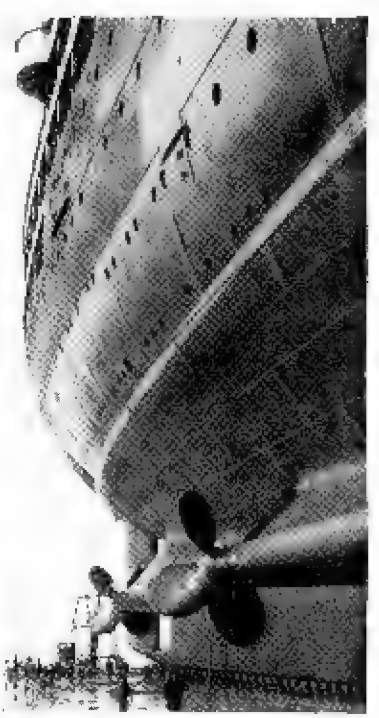
A Microscopic Jungle

IT took Herman C. Meller four years to make the glass-blown model of a single drop of water, magnified a million times, which now is on display at the Museum of Natural History in New York. . . . And perhaps after some of us view Mr. Meller's work, all the health maxims in the world will not drive us to drink H_2O again. For the model shows the savage rotifer that devours fellow organisms with his pincerlike jaws, and the bladderwort plant which absorbs stray animal matter—not the pleasantest things to imagine as occupants of a glass of cold water.

Champion Ocean Dachshund Recuperates

THE giant floating drydock at Southampton is hardly long enough to kennel the lean and massive Bremen, Germany's dachshund entry in the current race for the trans-Atlantic record. The Bremen laid up after its titanic championship efforts and rested in drydock until it was thoroughly overhauled and cleaned. The immense force exerted by the propellers and the corresponding resistance of the seawater resulted in chipped propeller blades, plainly visible in the close-up. . . . The pigmy proportions of the workmen indicated in the general view is a clue to the size of the ocean's fastest ship. Naturally, however, it is the extraordinary length and slimness of the German champion that count in the race, not the massiveness.





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Deep Sea Surgeons Mend World's Nerves

The cable ship Lord Kelvin was one of the stars of the cable-mending drama.

Out on the Wintry Ocean the Cable Ships Fish for Cables Snapped by Seaquakes, and Repair Them, so That Trans-Oceanic Communication Can Go On

LATE last winter a violent seaquake snapped ten of the twenty-one trans-Atlantic cables like threads. Three of the ten Western Union trans-Atlantic cables were silenced.

Men, aided by every contrivance known to science, have pitted themselves since that time in an unequal battle to mend those cables, against the violence of the Atlantic.

Each ice-incrusted and battered cable ship returning to port has had a story to tell of heroism in the face of great hardships and danger to be added to the romantic tales of old salts who spin yarns of the exploits of fearless cable crews.

How cable repair work is accomplished in the face of such difficulties may best be illustrated by telling how

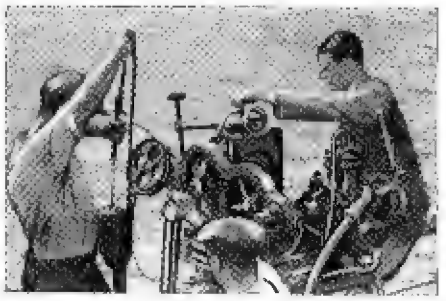
To guide the repair ship, a buoy is lowered with the end of the broken cable attached.

one of these cables was repaired.

The most powerful narrative of this struggle to reach shore thus far is the story of how the Western Union Cable Ships Cyrus Field and Lord Kelvin mended the high-speed cable laid in 1926 and broken by the seaquake in two places, 956 miles from Hammels, L. I., the New York terminus, and 327 miles from Bay Roberts, N. F.

By use of a galvanometer, electrical resistance of the broken cables from shore to shore was measured. Since electrical resistance is in proportion to the length of the conductor and similar tests were made and charted each mile as the cables were laid, it was possible for experts to figure the location of each break.

The exact position of each break was wired to a cable ship and the race to



On a special machine the broken cable is made whole again.

the scene began. One of the first to reach its goal was the Cyrus Field.

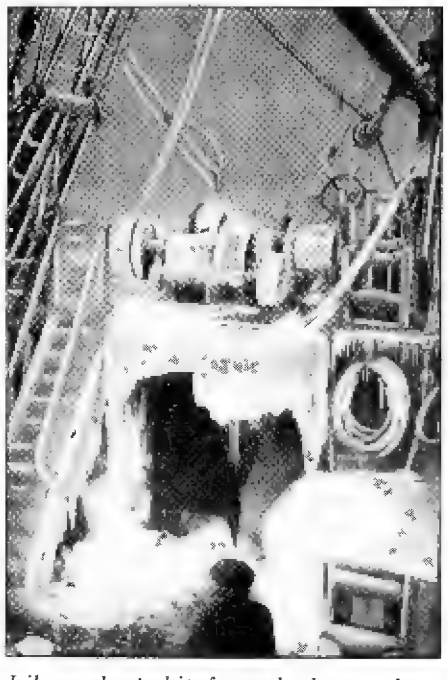
The ship dropped a deep sea cutting grapnel to the ocean bottom and dragged it by a line at right angles to the cable. It picked up the end nearest Bay Roberts, attached it to a large buoy which it left floating at that point, and then steamed away to grapple for the end nearest New York.

Violent storms and other urgent work prevented the Cyrus Field from raising the other end. The Western Union Cable Ship Lord Kelvin, then working with the Dominia to repair the 1924 New York-Azores cable, broken in two places 1060 and 1175 miles due east from New York and three and a half miles below the surface, went to complete the work begun by the Cyrus Field.

The Lord Kelvin seized upon the first moderate weather to grapple for the cable. It soon picked up a piece of cable, but attempts to signal in each direction proved it to be broken both ways. The ship pulled this piece of cable on board.

"The terrific force of the seaquake was indicated by the condition of the cable," Captain M. H. Bloomer, of the Lord Kelvin, radioed to the company. "The cable was mangled for 1,500 feet from the end," he reported. "Nearly all of the heavy sheathing wires with which the cable is spirally armored were broken and the ends were turned back; the core of the cable was 'squashed' in six-foot sections at frequent intervals."

The Lord Kelvin then grappled to the westward and was successful in picking up the end nearest New York the first time the ship passed over the cable. This was due to the fact that the cable had not been buried by the seaquake. The ship then spliced cable to the New York end and laid 100 miles of new cable to the point where the Cyrus Field had left the Bay Roberts end attached to the buoy. Because of the stormy weather and low visibility the ship found it necessary to buoy the new cable it was laying until it could locate the Cyrus Field's buoy (*Continued on page* 1139)



Like a ghost ship from the icy northern seas, the Cyrus Field came home.

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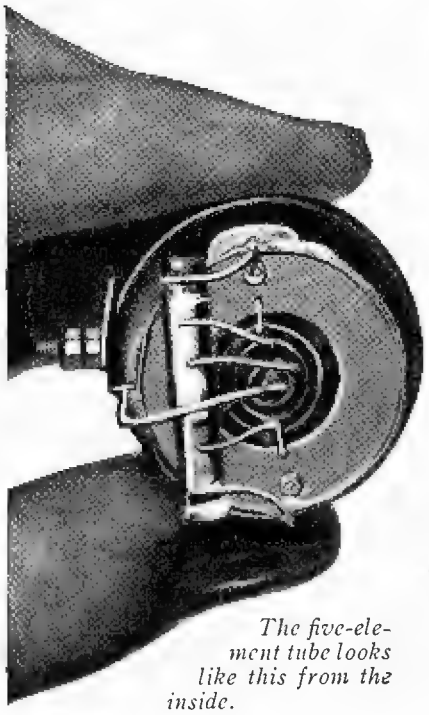
Here Comes the PENTODE

Another Element Is Added to the Vacuum Tube. An Interesting Development, But the Center of Much Discussion. We Present Both Sides of the Argument by Two Men Who Are Prominent in the Tube Industry



The five-element tube looks like this from the inside.

By Ernest Kauer

President, Ceco Manufacturing Co.

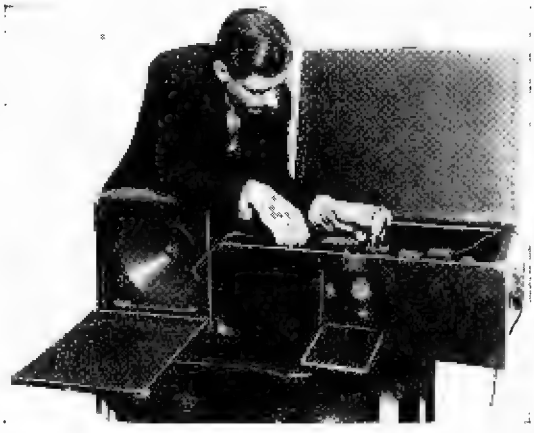
THE public has been asking for receiving sets which do not employ so many tubes. This new development will make it possible to build sets which satisfy that demand. Bringing, as it is bound to do, more simplicity into radio manufacture and receiver operation and maintenance, it will reduce manufacturing cost, material costs, and, costs to the radio public."

The new tube is a sort of double screen-grid, having a screen around the plate, as is the case with the screen-grid of the present; also another screen between the control grid and the cathode. The insertion of the second screen permits a greatly increased amplification three or four times as great as the screen-grid.

Mr. N. O. Williams, Chief Engineer of the Ceco Company, says, in connection with this new tube, "The screen-grid is a very wonderful tube, but the radio industry has not been able to develop a receiving circuit which permits the use of the tube's full efficiency. Nor is such a circuit likely to be developed. There are too many difficulties in the way.

The easier method has been to center research on the development of a newer tube which would make possible the building of a circuit capable of getting out of the tube all the power and valuable attributes inherent in it. This is what we have done in the case of the pentode.

The AC Pentode is a vacuum tube consisting of a standard indirectly-heated cathode, a space-charge grid surrounding the cathode, a control grid, a plate, and a screen-grid. It is designed for either the radio frequency or audio frequency circuits. The new element—the space-charge grid—has a potential of 10 to 20 volts.



Franklin Snow Huddy, engineer, places the new pentode in a special set.

By Lee de Forest

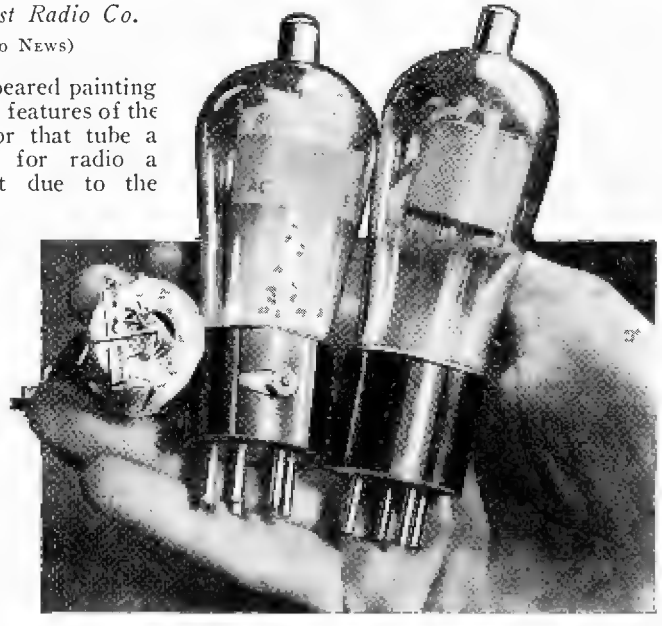
Vice-Pres. De Forest Radio Co.

(*Courtesy of* Radio News)

Statements have appeared painting in glowing terms of the features of the pentode, predicting for that tube a brilliant future, and for radio a startling improvement due to the latest vacuum tube. My own opinion is that such statements issue for the most part from the press bureaus of manufacturers looking for a new selling point.

Personally, I have great doubts about the pentode being such a great improvement over the screen-grid tube. True the pentode has great undistorted output and eliminates one stage of radio frequency amplification. But its disadvantages are many. The great number of broadcasting stations at present on the air, one crowding on top of the other, makes the reduction of tuned circuits, resulting in the use of the pentode, a distinct disadvantage by lessening selectivity. Moreover, the pentode will cost more to manufacture. Although the consumer will have less tubes to buy, he will have to pay more for those he purchases. And if but one element burns out, the entire tube will have to be discarded. Nor is it easy to manufacture the pentode with uniformity. It is a hard tube to handle, and causes the receiver to misbehave. At least these have been the difficulties in the past. Maybe they have been met in one degree or another.

The pentode may find use in one-tube transmitters, but for the present and immediate future I predict that there will be no reason for the public to defer the purchase of new radio receivers.



The five-element tube differs from the screen-grid tube in appearance. The pentode has a connection through the side of the base for the space-charge grid, besides the usual connections of the screen-grid tube.

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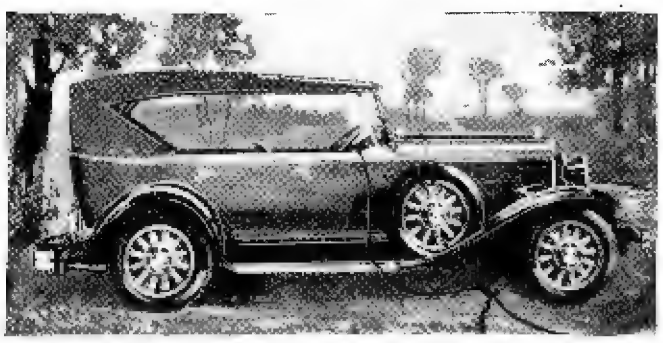


In this snappy Chrysler, a flip of a dashboard switch and the turn of a dial give you radio entertainment.

Radio Rides *the* Roads

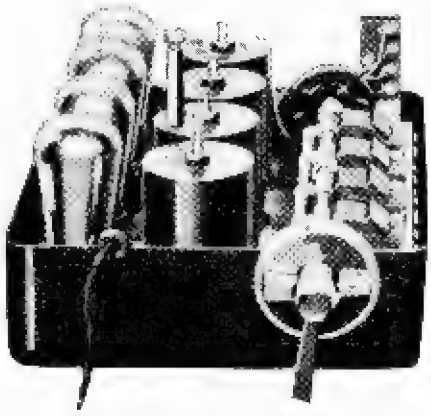
Tourists Take Heart! Music at Your Fingertips! Receivers May Now Be an Integral Part of Your Car

By George R. Brown

YOU can picnic and tour with musical accompaniment this summer. You can flip a switch on the dashboard of your car and hear strains of the latest song or the wisecracks of your favorite radio comedian. You can inject a note of gayety into the picnic without the trouble of a wheezy phonograph, if you install the latest radio receiver in your car. No more musicless days and nights; no more winding of phonographs; no more slightly stale ukelele parodies to listen to.

The auto radio receiver is the latest achievement of radio science, and with the new models available you can be assured of good reception. You need not fear the noise from your motor, you need not bother with additional batteries, for all of these sets are designed to cope with the problems of auto radio—they are *not* just radios installed in autos. Ignition troubles, tube noises, and similar head-aches encountered by the radio fan who would install a receiver in his car have all been removed by engineers. Now you merely sling your antenna on the roof of the car, place your set beneath the cowl, connect your battery leads, turn the switch, and there you are—radio riding the roads. Several cars are being manufactured with antennae built into the roofs. Many of them have been made ready for ignition shielding. These include Cadillac, La Salle, Franklin, aChrysler, and Dodge. Several companies are producing receivers which may be installed in *any* car. They are Automobile Radio Co., National Co., Silver-Marshall Co., Delco-Remy Co., and Wireless Egert, Inc.

We do not recommend your installing your present radio in your car. This is not because we are in league with the manufacturers of radio sets but



The Transitone radio is now being installed in many makes of cars.

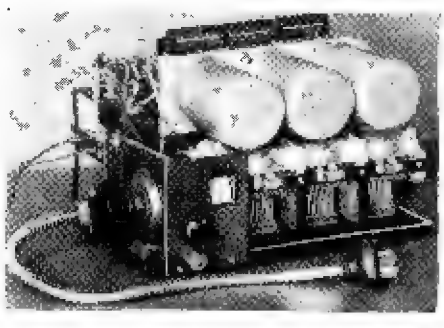
because we know that it will provide only a constant source of annoyance to the driver. You may have a set which was left behind in your hurry to buy an electric set; don't use it in your auto. It will be too much of a drain on your storage battery. It will be noisy. It will give very poor selectivity. It will break tubes because it is not designed for the constant bouncing which it will experience on the road.

The new sets designed for automobile installation will do everything that your old set will not do. They are practically noiseless. They have good selectivity. Their tubes will not break. They will not drain your car storage battery. They are compact. They assure maximum amplification due to the use of screen-grid tubes. The tubes are subject to less microphonic noises because they are alternating current tubes used in a battery circuit.

There are many problems relative to the efficient operation of auto radios. Not the least important of these is that of proper shielding from ignition and motor interference. There are three systems which have been used to good advantage in this connection. One is the complete shielding of the entire ignition system by cables in metallic housings, with shielded spark plugs applied to the motor. Another is the more simple proposition of including resistances in series with the spark plugs, and one in series with the central contact on the distributor. Another, and perhaps the cheapest and simplest, is the use of a separate storage battery from the car battery.

A second problem is the correct designing of a circuit so as to obtain maximum amplification with the small antenna available. It has been found that two stages of tuned radio frequency, using the screen-grid tubes, provide sufficient signal amplification. This should be followed by a hi-mu detector feeding into a resistance-coupled audio tube, having as a second stage a standard 112 output tube. It has been found that resistance coupling is not only a space-saving factor but also gives a very good reproduction curve.

One of the most important considerations in the installation of an auto radio receiver is that of proper suspension. This is absolutely essential, otherwise broken tubes (*Continued on page* 1142)



The National Company offers this set as an example of a compact and efficient auto radio receiver.

You sit beside your campfire and enjoy the music.

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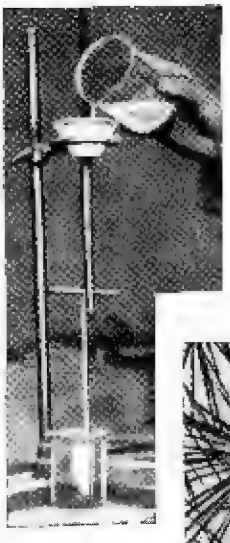
Make a Chemical Nest of Serpents

You Can Conjure "Snakes" From a Simple Cyanogen Compound

By Dr. E. Bade

Dissolve a drop of mercury in concentrated nitric acid. Use a large flask for dark brown fumes are given off.

You can detect nitrogenous material in a compound with the aid of metallic sodium.



Filtering off the precipitate of mercuric thiocyanate.

THE cyanogen compounds are peculiar, especially in their relation to the organic and the inorganic fields. The simplest union of carbon and nitrogen gives us (C_2N_2) cyanogen, an extremely poisonous gas. This is formed by two cyanide radicals (CN). Cyanogen acts, chemically, like chlorine, thus it unites directly with metals, often with the accompaniment of fire.

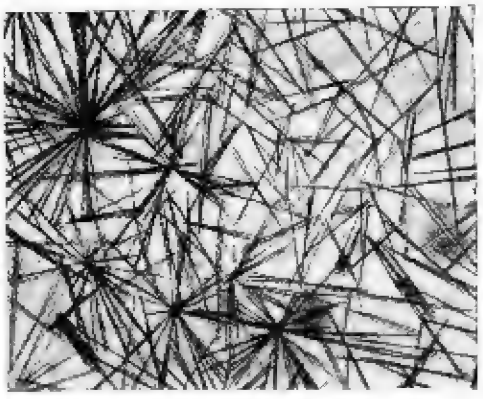
The metallic salts of hydrocyanic acid are almost indispensable in the electroplating industry. Here the gold or silver forms a double or complex salt which permits the perfect electroplating of the noble metals on base metals. When silver nitrate is dissolved in water and potassium cyanide solution is added, silver cyanide is formed as a white, curdy precipitate. On further addition of potassium cyanide solution, the precipitate dissolves and forms a complex of potassium silver cyanide.

Probably the most peculiar salt of all is mercuric thiocyanate, an insoluble powder which, on ignition, forms one of the most voluminous ashes. Dried pellets of this material are known as Pharaoh's serpents and these, when lighted, burn slowly producing long curled snake-like tubes of ash.

Dissolve mercury in nitric acid to make mercuric nitrate. In the meanwhile make a solution of sulfocyanide of ammonium by taking 10 cc of carbon bisulphide, 40 cc of concentrated ammonia and 40 cc of alcohol (denatured) and mixing. At first the mixture will be milky. Then it will turn to yellow, change to orange and finally to red. When all of the carbon bisulphide has been dissolved, which takes about two hours, place in a beaker and boil gently in a water bath until the red color has disappeared. Then evaporate, still on the water bath to the point of crystallization. Then pour the liquid slowly and in small portions into the mercuric nitrate solution. Collect the resulting precipitate and wash once or twice with a little water. Then dry. Take the dry powder and mix with a little gum arabic or better, gum tragacanth, and mold into pellets or small cones. Dry on a piece of glass and when dry they may be ignited. But take care not to inhale the vapors.

After the precipitate is formed, mix it with some gum arabic, and then form into pellets.

These pellets may be ignited after they are dry. They will yield a voluminous ash in the form of a writhing serpent.



Needles of mercury fulminate enlarged fifty times.

Quite a number of the more complex metallic cyanides form very interesting salts with unique properties. Mercury fulminate is such a product. It is prepared by warming a solution of mercuric nitrate with alcohol. After the brown fumes have been developed, the salt is obtained as silky needles. Or it may be made by dissolving one gram of mercury, placed in a large flask, with 9 cc of concentrated nitric acid. Then, after cooling, 6 cc of alcohol, 90 percent in strength, is added. After shaking, 6 cc of alcohol (*Continued on page* 1134)

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Dancing Down *the* Centuries

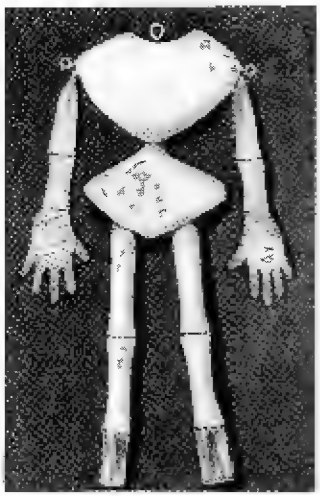
Loved by Lowly and Great, the Puppets Play on . . . Here You Learn How to Make and Manage Them

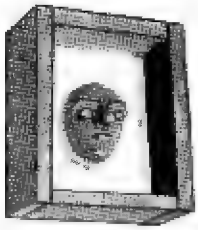
By Jo La Spina

The puppet master controls most of his actors' movements from one hand. This is Jo La Spina himself, who shows you the details of the multiple control on the continuation page.

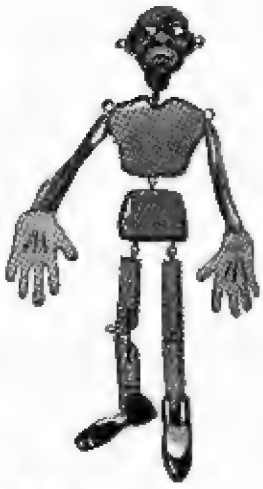
DO YOU like puppets and puppet plays? . . . If you do, you share an emotion that links you to children, to simple peasants, and to the greatest minds of the world. For the greatest minds no less than the country folk of Italy have found delight in the antics of the eternal—and universal—marionette.

Perhaps your acquaintance with puppets has been gotten through Tony Sarg or Jean Gros, the most renowned manipulators of marionettes in America. Each year the roadshows of these puppet masters circulate through the East and Middle West, playing repertoires which are often elaborate and which nevertheless are performed without the slightest hitch. The marionettes, with their ventriloquial voices and jerky movements, have a fascination peculiar to themselves, and a realism quite as convincing in its way as that achieved by talented human actors.





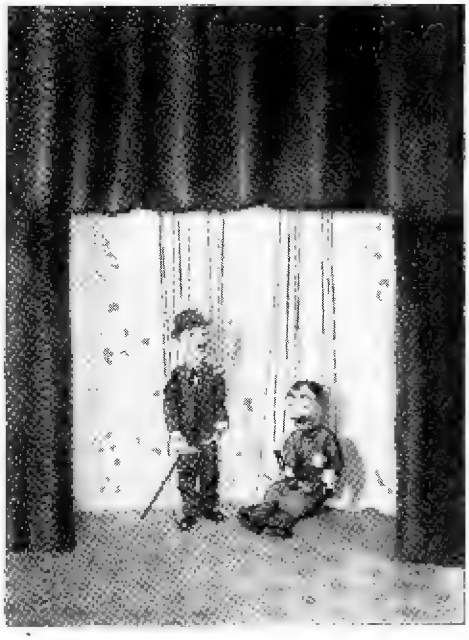
The head is cast from plaster. The body is constructed in one of the two ways illustrated.



Or perhaps you have happened upon the puppet shows which thrive in the Italian quarters of large American cities. The Italians are tireless in their devotion to the puppet play, and pursue it in their adopted land with the same ardor they display in Italy. Often their shows are simply improvised by the puppet masters as they go along, but sometimes they follow an established pattern of intricate type. . . . Some of you may even have seen puppet shows conducted by the author, though the likelihood of this is limited by the fact that he is still young and not as widely known as several other puppet masters. However, he has spent a good share of his life thus far in fashioning puppets and manipulating them for the entertainment of others. In the process he has gained considerable enjoyment for himself, and he believes that you will find it enjoyable too.

Making a puppet is a rather easy and very interesting task. The author will describe its essentials to you.

It is a simple matter to get some plasterline clay—a variety which never hardens. This is usually sold in art stores and large department stores. You model the puppet's head with this clay. Make the indentations for the eyes, and lips, shape the ears and nose, and fashion the shape of the head. When this is completed place the head in a wooden box with the back of the head to the bottom of the box. Leave an inch around the head, and fill the box with plaster of paris. When this becomes hard, brush some vaseline along the hardened plaster. Mix another quantity of plaster and cover the entire face which is exposed.



Within an hour, break open the box and the cast will split in the center. After taking the soft clay away, you will have two halves of a mould. Next get some newspaper and cut into strips of an inch or two square. Place them in a pan of warm water until well soaked. Mix some white paste with water until a creamy consistency is reached. Then place each strip of paper in the dry mould, until seven or eight layers have been built up. Spread a layer of paste over each strip of paper, except the first layer. Place (*Continued on page* 1136)

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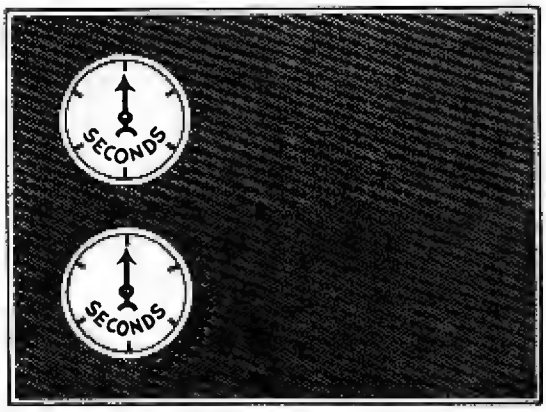
When *Speed* Makes *Time* "*Run Slow*"



Viewed from either of the planets on which they stand, the clocks in this diagram appear to agree; the planets are traveling at equal speed. (From the Einstein Relativity Film.)

Light, Space, and Motion Make Ducks and Drakes of Time Measurement in the Einsteinian Universe, the Relativist Shows, in This Continuation of the Menzel Series

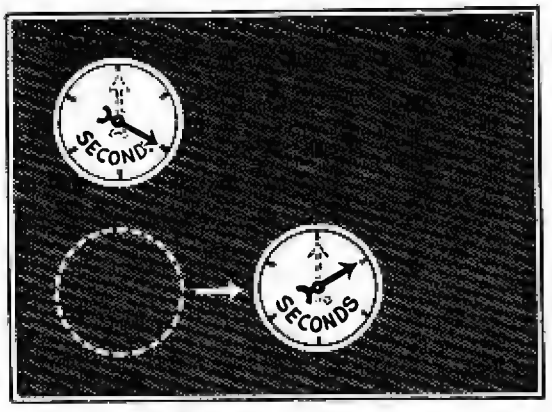
By Donald H. Menzel, Ph.D
Lick Observatory, Mount Hamilton, California

LAYMAN—You have emphasized again and again that all motion is relative. Instead of adopting your viewpoint, why not climb into the aviator's carriage and watch the earth fly past in the other direction at 161,000 miles a second? If, as you say his watch is slow, he then could see that ours is running fast, and if he is smaller, we of course should appear larger. Consequently, he could prove that it is himself —not the earth—that is moving. Is this not a refutation of relativity?

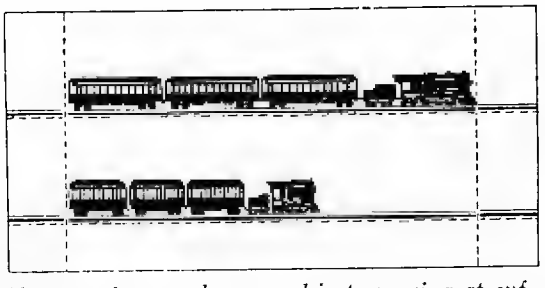
Relativist—It would be indeed, if what you say is true. But note that I said his clocks *appear to be*, not *are*, running slower. The curious point of the matter is that he, on looking at my watch, will infer that it is running at half speed, compared to his own. And we appear contracted.

L.—That seems a very curious paradox. If you and I compare watches, how can they both be slow with respect to each other? How can we both seem smaller to each other?

R.—If you and I are both standing on the same platform, whether it is moving or not, there is no distortion. But if you are shooting past me at 161,000 miles a second that is a different matter. I cannot see you as you really are, partly because of your speed and partly because light is not transmitted instantaneously. You are unconscious of any distortion because all of your standards of length and time have suffered similarly. From your point of view, then, the distortion is only an illusion of mine that arises from my viewing your rapid motion across the intervening space.



When one of the planets hurtles past the other at high speed, its clock, viewed from the other planet, seems to run at a slower rate. (Einstein Relativity Film.)



To a stationary observer objects moving at sufficient speed appear shortened. (Einstein Relativity Film.)

In view of these facts it is not particularly surprising that I shall seem similarly distorted to you. It is much as though we were looking not at each other, but at each other's images in one of those warped mirrors always to be found in an amusement palace. If you appear shorter than you really are, that is no reason for supposing that I shall appear taller to you.

Physicist—Why does the velocity 161,000 miles a second figure so prominently in your statements?

R.—Only because the distortion is exactly half for that speed. I chose it for the purpose of a simplified illustration.

L.—Would not a fast moving automobile experience such a contraction?

R.—Of course. But for the familiar velocities, the contraction is extremely small. An airplane racing at 400 miles an hour will be shortened by a ten billionth of an inch—about a hundredth of the diameter of an atom. While the aviator's clocks run slower, more than 100,000 years would have to elapse before they would be slow by so little as a single second.

L.—Then why do you make so much fuss about a trifle?

R.—When we come to the speeds of the planets and stars, the effect is just appreciable. Where Newton's laws predict no distortion, we find distortion, and it seems to conform to Einstein's laws. There is another point, too, where there is a difference.

With the spectroscope we can measure the velocities of stars and groups of stars. Individual stars, in our Milky Way system, appear to be moving with speeds anywhere from 6, 8, up to 20 miles a second. Of course, some are moving more slowly and some more rapidly than these figures, but the range of velocity is not great.

It is rather difficult to measure the speeds of the spiral nebulae, clusters of millions, perhaps billions, of stars; they are so faint and so far away—a million and more light-years distant. Sometimes it is necessary to take a "time exposure" of some forty hours' duration, in order to get a properly exposed plate, even when the light gathering power of the great Mount Wilson 100-inch telescope is employed. But the difficulties have been and are being surmounted. The velocities of a number of spirals are now known with considerable accuracy. They range (*Continued on page* 1135)

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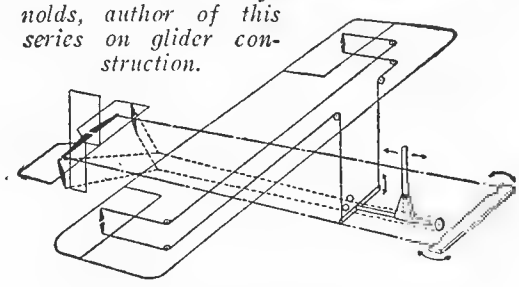
One More Step *to the* Take-Off

Lieutenant H. A. Reynolds, author of this series on glider construction.



Here the Author Covers the Controls and Launching Hook Stage in the Construction of* SCIENCE AND INVENTION'S *Primary Training Glider; the Fourth Article Covers the Finishing Touches

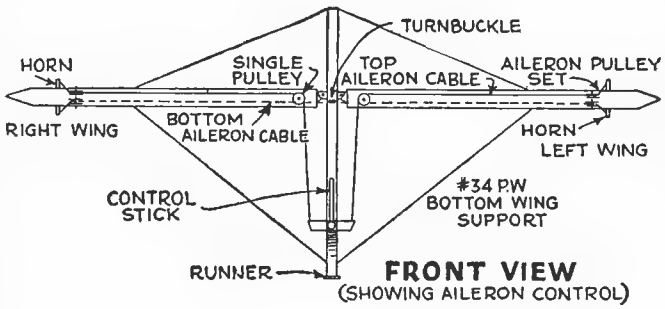
By Lieutenant H. A. Reynolds
Syracuse, N. Y., Glider Club

THE control stick assembly is constructed next, and the original all-metal assembly presented by Mr. Northrup, in the July, 1929, issue of SCIENCE AND INVENTION, is the strongest and most economical one for our purpose. It comprises two seamless steel tubes connected by metal yoke. All metal parts for this unit can be fashioned at home. If it is convenient the control stick yoke and elevator sheave yoke can be welded in position on the horizontal tube by a professional welder. The aileron lever which is slipped over the rear end of the horizontal tube can also be welded in place at this time. This is done in up-to-date auto-repair shops at low cost and is very strong when correctly done. If it is not possible to weld them, the connections may be riveted through the rivet hole positions shown in the drawing. Great care is necessary in securing the yokes and aileron lever to eliminate all possible play between them and the horizontal tube which might result in lost motion in the control of the glider.

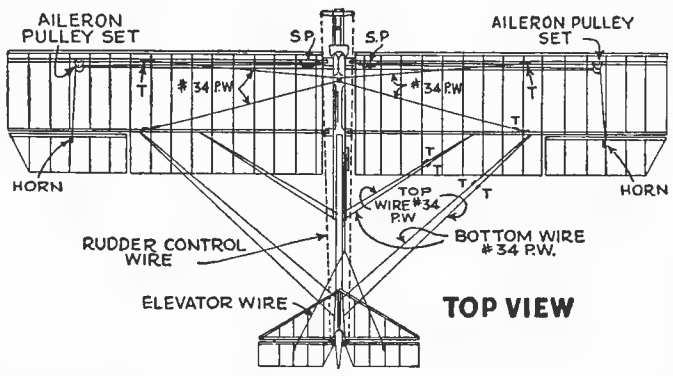
Connecting the flexible elevator control cable to the pointed lower end of the control stick has presented quite a problem. But the control stick connection link offers an easy solution. Make one link of No. 10 carbon steel to the dimensions shown in the drawing. The 13/64" hole in the center is for connection to the control stick and the ¼" rivet in the fork at each end is for the flexible elevator control cable attachments.

Launching Hook

THE launching hook is made of No. carbon steel as shown in the launching hook drawing. Make a paper pattern of the side view and lay it on the metal. The two sides cut to this pattern can be riveted securely with ¼" rivets at the hook section. It is a good plan to make both sides of this fitting double, for if the hook fitting should bend and let the ring on the rubber launching rope slip off, a serious accident to the ground crew might result. The writer had one launching hook bend in this manner. Fortunately the metal ring flew clear of the prostrate ground crew, who, nevertheless, piled up like ten pins.



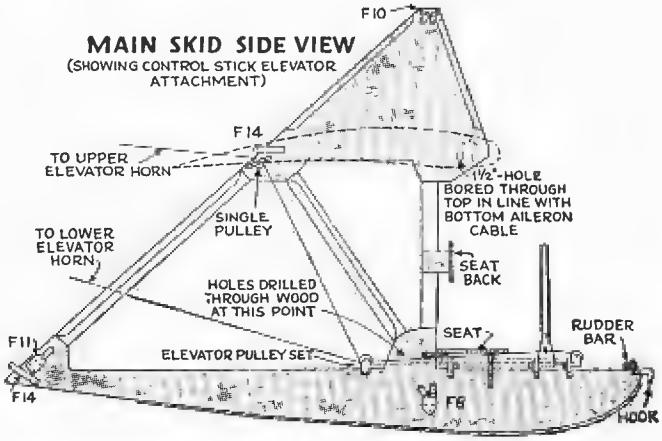
CABLE CONTROL DIAGRAM



The seat, seat back and seat brackets are cut and sanded to the dimensions specified in the drawings. The seat assembly and seat back are the last units to be installed on the glider, so after giving them a good coat of varnish they may be temporarily laid aside. Do not attempt to put them on at this time as their exact position is not yet determined.

Elevator Control Pulleys

ONE set of elevator control pulleys are made with No. 14 carbon steel sides and two free rolling aluminum pulleys. These are bolted to the top of the runner on the main skid section about three or four inches back of the plywood covered strut ends. Then the control stick assembly can be set in position and with a (*Continued on page* 1145)



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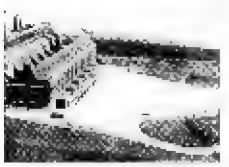
The way I see it—

By Murray Godwin

Late Springs Banished

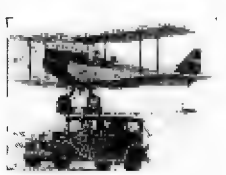
WITHIN the next few months the familiar glass-domed stock ticker will be replaced throughout the country by a new quotation printer having twice the speed of the old. Already the work of replacement is well advanced. . . . In the old ticker a separate wire supplies impulses which continually rewind a clock spring that serves as the power-plant, while selective and printing signals come in over a wire of their own. The new job will be operated by a motor drawing current from a local source, and the single wire to the ticker itself will carry signals only. Speed in the old ticker was limited by the fact that it performed the functions of selecting and printing in succession; the new ticker simultaneously prints one character and selects the one to follow—it has a new and thrilling bit of information in storage all the time. The number of impulses needed to print a character is reduced from sixteen to eight by the new machine, and its speed-increasing factors make possible a printing rate of 500 characters per minute, as against the former rate of 200-odd. . . . Three years of experiment by Western Union and other engineers were necessary to bring the ticker into tune with turnover as financial circles know it today.

Come, River, Milk the Cow



ALWAYS strong for giants and for fairies who do people's work for them, the Irish at last—with the aid of a German wizard—have found giant and fairy both in the waters of the Shannon. . . . After centuries of doing nothing more arduous than inspiring ballad makers, the old river is soon to enter on a period of use and romance that will make it pre-eminently the river of all Ireland. Six 30,000 kw. generators in the Siemens-Shuckert powerhouse will develop current to light huts in Sligo and churn butter in Kerry and Louthe. In many a cottage electric light will supersede tallow candles. In many a household, current from the Shannon hydrostation will wash clothes which previously were washed in the Shannon itself. . . . Here is as much magic, surely, as any Irish story-teller ever dreamed of, and it covers far more territory in its effects.

The Bird on Lizzie's Roof



THE idea of launching planes from speeding carriages, discussed a few months ago in SCIENCE AND INVENTION, has been worked out with such simple means as a motor car equipped with a roof platform, at Old Orchard Beach in Maine. Chocks prevented the wheels of the plane (a Moth) from rolling; the tail skid rested on a frame extending from the rear of the car. As the driver of the car increased his speed, the pilot of the plane opened up his throttle. When the car hit 52 m.p.h., the pilot removed the chocks by pulling a trigger control, gave her the gun, and took off so easily and smoothly that the operator of the motor car was not aware of the fact. Aviation men, impressed by the low speed necessary for the take-off, see in the near future thousands of small plane owners freed to a great extent from the inconveniences attending the use of regular flying fields. . . . As a promising ground flyer, I confidently predict that automatic chocks and extension tail-skid rests will be listed as available equipment for next year's Ford—at least in the closed models. The year after that you will be thrilled, in the course of a suburban drive, by having a small boy shout at you, "Hey, Mister, there's a sport plane on your roof!" For by that time enterprising pilots will be *landing* their ships on motor cars also.

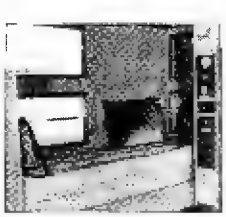
To the Ostrich Goes the Plume

SCIENCE, of a very crude and applied sort, has discovered why the ostrich hides its head in the sand. It seems that all these years the silly bird has been aching to give the world the horse laugh and has taken this means of concealing it until it could loose an outburst that would shake the world. . . . Now the laugh is out, and it's a world-shaker sure enough. Just when the market for diamonds was getting into desperate shape, the gizzards of African ostriches began to reveal themselves as repositories of an abundance of these once precious stones. Evidently the birds had developed a knowledge of the excellent grinding qualities of diamonds, and have made a point of using them wherever they are to be found. . . . As if this were not sufficient, prospectors—perhaps guided by the ostriches—have found a new diamond field in the Transvaal, where the stones are described as being "as plentiful as pebbles" and as lying practically on the surface of the soil. Thus catastrophe has come to the diamond industry, over which wars have been fought and on which vast fortunes have been built. Despite government restrictions on marketing the stones, the new sources are bound to swell the supply to enormous proportions, and the consequence will be a swift drop in diamond values everywhere. . . . So keep your eye on Woolworth's.

Darkness and Tossing Horns

AFTER sitting in on a seance at the Hotel Governor Clinton while Medium Frank Decker contested for the SCIENCE AND INVENTION $21,000 spiritism prize. I came to the conclusion that Joseph Dunninger probably produced his end of the phenomena by supernatural means. Mr. Decker, who had a grapevine twist on Mr. Dunninger during the latter's performance, went on record to the same effect. As champion of Science against Spirits, Mr. Dunninger declared he makes use of physical means only, of course, but I prefer to judge by what I observed in the darkness, amid the tossing horns. . . . It's fun being arbitrary, anyway, and there is no use of becoming an editor if you don't exercise your right to be arbitrary whenever you get a chance. . . . Not that I feel very keenly about the existence or non-existence of spirits with a yen for horn tossing. The fact is, I am a slow-witted creature, and things on this side of the Beyond are still a good deal of a puzzle to me. I feel that I must understand considerably more about this world before giving the Spirits a turn.

Accordion-Pleated Luxury



CROSS-CONTINENTAL highway vehicles have certainly come a great way since the Forty-niners ambled across the plains. The 1930 style of caravan coach has running water, electric lights, and imperially upholstered lounges which are convertible into luxurious beds. When you pull out of the road for a spell of sleeping, eating and loafing, you extend the width of your rolling palace simply by letting out a few pleats in the accordion sides. This gives you an apartment as wide as a railway coach for your hours of ease. . . . The supremely appropriate name for a coach of this type, naturally, is the *Concertina*. That is what I intend to call mine.

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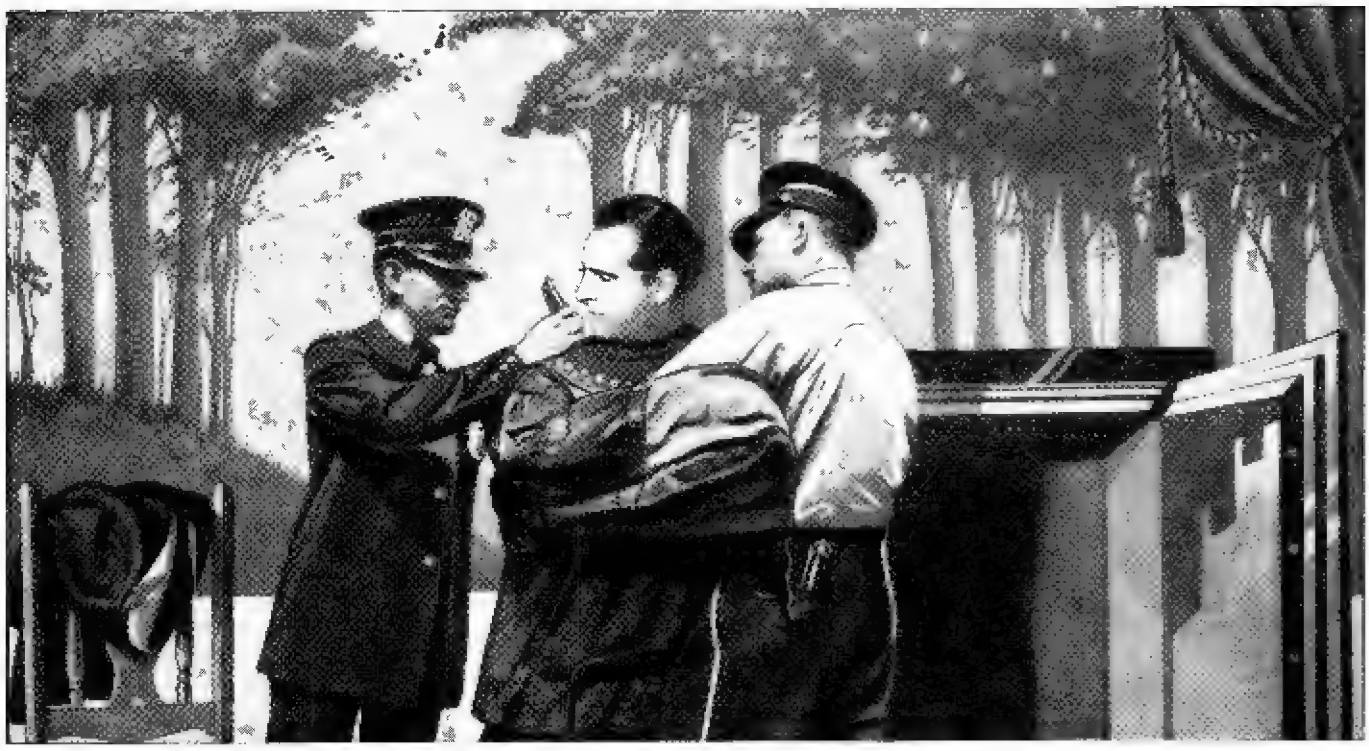
When the Fates Fooled Dunninger



By Dunninger

Tricksters Who Constantly Toy With Fate Sometimes Find That Fate Plays Pranks on Them. In This Story by Dunninger About His Own Experiences, Dunninger Leaves the Only Two Tools Necessary for Opening a Safe From the Inside, a Screw-driver and a Flashlight, in His Coat Pocket; Then Has Himself Locked in the Safe Without His Coat. With the Supply of Oxygen Failing . . . Read What Happens.

TO anyone who wishes to succeed as a magician I give the same advice . . . practice and study, then practice again. Some take the advice; others do not. For the fact remains that to reach the top in magic, mind reading or kindred arts, one must give the best there is in him. He must aim to be original, if not in the experiments selected, at least in the presentation of them. If you are a patter magician, be sure of the type of patter you use. Don't rewrite or copy the other fellow's material. Have patter especially written around your tricks. It costs very little proportionately, and the results are well worth the expense. But to get to my experiences.

Many years ago I purchased the entire stock of magic from the Crest Trading Company and circulated extensively throughout the world. For months I was deluged with orders for magical apparatus and tricks. I was surprised at the vast number of people interested in magic. I employed quite a staff filling and mailing out orders. Among the orders received were some that afforded me many laughs.

For instance, one fellow in South America sent in an order for what is known to magicians as a pigeon pan. The effect in brief to an audience is a highly nickeled pan, something on the order of a chafing dish, placed on a table into which several eggs are broken. These are then seasoned with salt and pepper. These ingredients are mixed together and a cover placed on the pan. A few magic words, or a revolver is fired, and when the cover of the pan is removed, live pigeons fly out of it.

The effect is startling and sure-fire. Well, to get back to my story . . . the fellow who ordered it immediately wrote me that he received the pan and was pleased with it, but the pigeons had not, as yet, arrived. Naturally, no pigeons are included with the trick, as a pair can easily be procured anywhere. Feeling in a jesting mood, I answered the would-be magician's letter and told him that I had sent the pigeons out to him through my window, with his name and address tied around their necks, but due to the storms, perhaps, the pigeons had sought shelter and would eventually arrive. Some weeks later the fellow wrote back informing me that although he had slept for several weeks with his windows wide open the pigeons hadn't put in their appearance.

Another order came for a production bowl to produce candy. The customer wrote that he only wanted a bowl that would produce, by magical means, creamed chocolates, as his sweetheart preferred that kind of candy. He also wanted to know if I would guarantee the quality of the candy the bowl would magically produce!

The levitation of a woman in mid-air was also advertised in my list and a South American, who had fallen in love with the Goddess of Magic, sent an international money order for the effect, explaining that when I sent the apparatus I should be sure to send along a blonde woman with the outfit because he claimed that blondes were more to the liking of the people of his country!

Just before I closed out the entire stock I received a long letter from a woman who wrote she was poor but honest, and although she couldn't afford to purchase, for cash, a money-catching wand which I had advertised, she would send me letters of reference if I sent her the wand and she would in return forward me one-half of all the money she could catch. She also asked how many half dollars she would be able to (*Continued on page* 1159)

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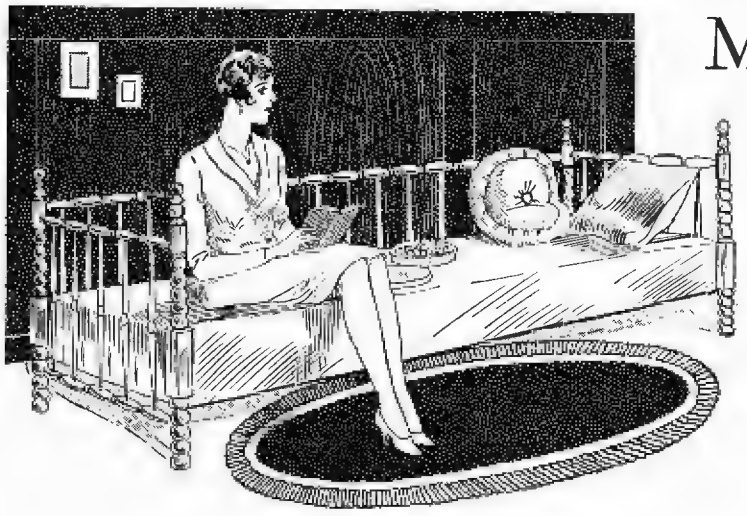


Make *an* Attractive DAY BED *for* Your Home

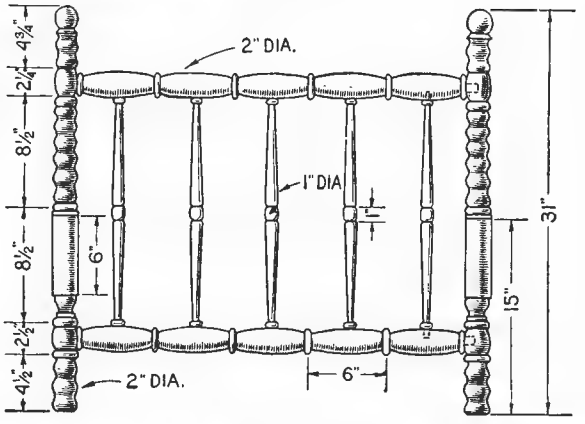
By H. L. Weatherby

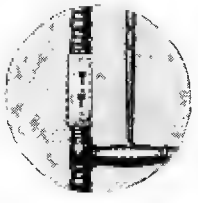
"WE'D love to have you stay over — but there isn't room."

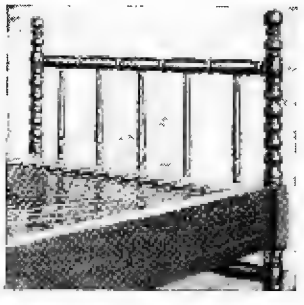
How often have you said this? Why not *make* room? A studio or day-bed will fit into almost any room of the house, and can be made to harmonize with the general tone of furnishings or decorations. For sleeping accommodations in the informal living-room, you can add a back, some deep, decorative cushions, and you have a davenport or settee. In the library, den or studio, for waking hours you have an inviting lounge for reading. For the regular bedroom, you can make a single bed, or twin beds for daily use.

With only a fair knowledge of turning and general woodworking the amateur mechanic can make a studio or day-bed that will require no apology.

Two different designs are furnished. The one having considerable more turning is a little more difficult to assemble, and of course calls for more lathe work. It is fashioned after the old-fashioned spool beds of our grandparents' time, that are so popular now; and will look well in any part of the house. Detail dimensions are not furnished in either case, because it was felt that they were not needed. The other design fits into the bedroom better than any other part of the house, perhaps; but with a colorful spread and bright cushions it is most inviting wherever it may be placed and its use is obvious.





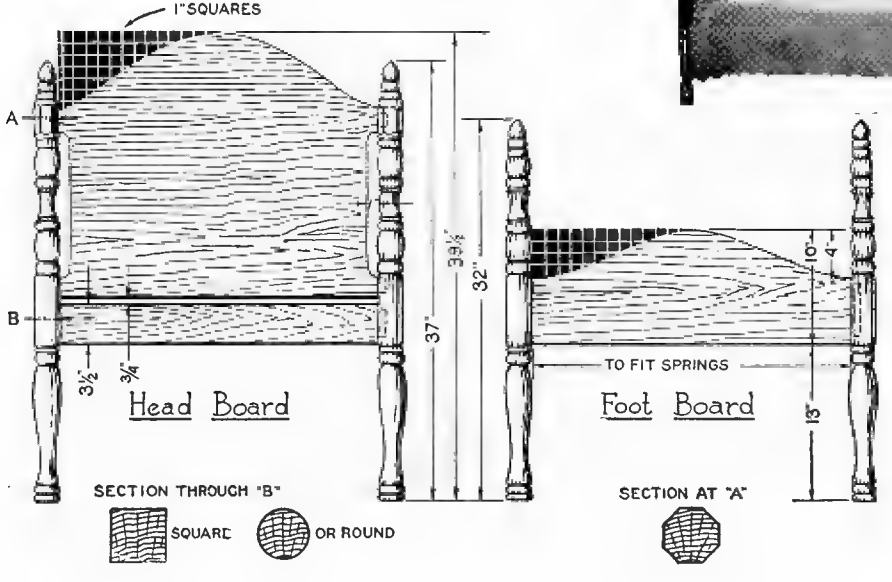


Sockets for holding the bed rails of the day-bed are placed on the vertical posts. The spool-type bed, completely assembled, is shown above.

Four blocks are placed on the bed rails to hold the springs in place.

Before beginning construction of either, it would be well to secure springs. Often there is an old folding cot, with a good set of springs, around the house that has outlived its usefulness. A steel army cot with good springs may be secured from an army supply store, or springs for a single bed may be purchased from the furniture stores. In case a cot is used, the legs must be removed, leaving only the springs attached to the frame. The width of the bed will of course depend upon the size of the springs secured and construction may go ahead from this point.

Here is the completely assembled day-bed, made up, inviting one to a comfortable rest.



The four posts should be turned first.

In case the lathe is not long enough to accommodate these full length, they may be turned in two sections and glued together. Round tenons, and holes bored for mortises, will give the best results. This same method will have to be used in case a long back rail is used; constructing it in two, three, or more sections, and great care must be taken to keep it (*Continued on page* 1136)

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From Old Lancaster

Come These Suggestions for

Tea Table *and* Foot Stool

By
J. E. Lovett

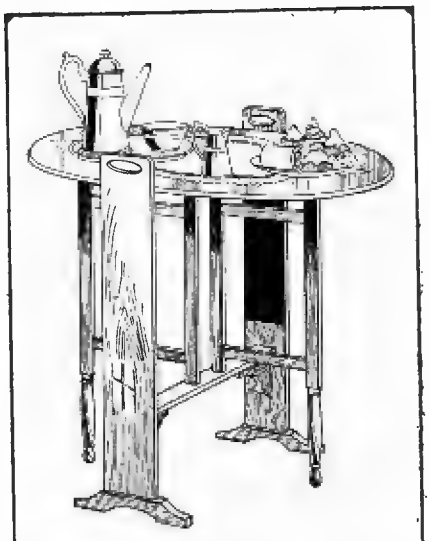


FIG. 1 TEA OR SUPPER TABLE
HEIGHT 28 INS., TOP (OPEN) 28 INS. BY 24 INS.

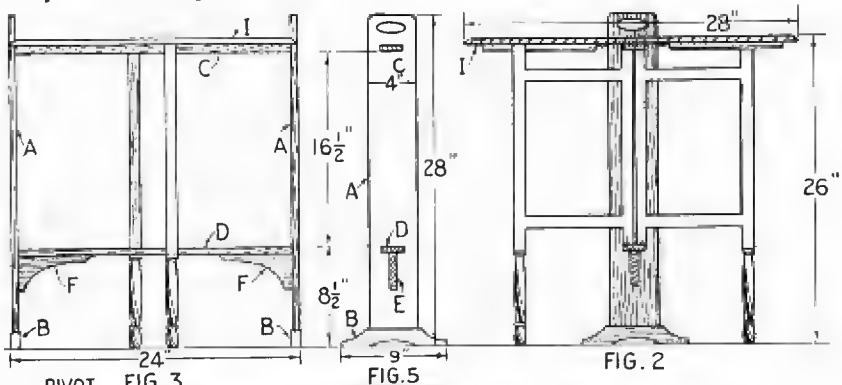
THE table sketched at Fig. 1 may be made without much labor or expense, and would prove to be one of the most serviceable of the lighter pieces of furniture which could be provided for the home.

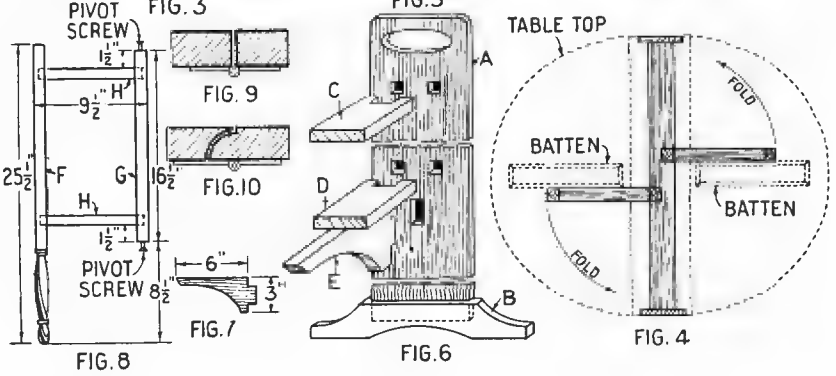
It is equally useful for serving afternoon tea, supper by the fireside, or tea in the garden, while, being made to fold, it may be easily moved, and would occupy but little space. The table could be made in any of the cabinet hardwoods. Elevations with the principal dimensions are shown at Figs. 2 and 3, a plan at Fig. 4 and working details at Figs. 5 to 10.

The sides (A Figs. 5 and 6) are 27½" long by 4" wide by ½" thick. Hand-holes are cut at the top ends, and the bottom ends are framed into feet (B), which are 9" long by 1½" wide by ¾" thick. The sides are joined by two cross framing rails (C and D), 23¾" long by 2" wide by ½" thick, tenoned in place, and the bottom rail is strengthened with two bracket pieces (E), 6" long by 3" wide by ½" thick, shaped as shown at Fig. 7, tenoned into the sides and screwed to the rail.

The two folding leg frames which support the table top are made with a leg (F) and a back upright (G), framed with two rails (H), as shown at Fig. 8. The leg is 25½" long, either turned or tapered at the bottom end. The upright is 16½" long, and the two rails 9" long by 1" square. The leg frames are pivoted to the framework by driving screws through the top and bottom cross rails (C and D) into the ends of the uprights (G), as shown at Figs. 2, 4 and 8.

The table top (I) is 28" long by 24" wide by ½" thick, made in three portions, as shown at Figs. 2 and 4. The middle portion is fitted over the sides, and screwed through the top cross framing rail. The flaps should be strengthened with 2" by ½" battens and hinged to the middle portion with a square joint, as at Fig. 9, or a rule joint as at Fig. 10.





Fireside Footstool

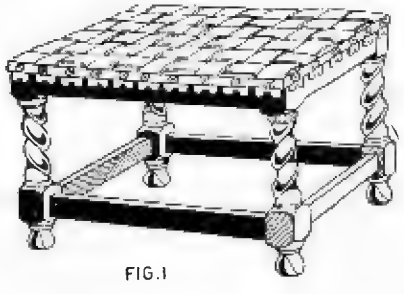


FIG. 1

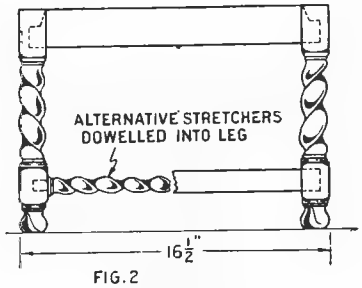


FIG. 2

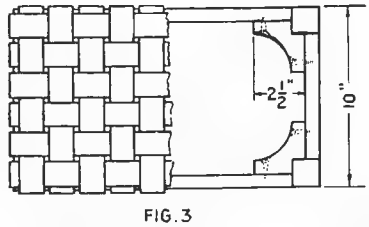


FIG. 3

THE sketch (Fig. 1) and the elevations (Fig. 2) show a footstool measuring 12" in height, 16½" in length and 10" in width, but those dimensions may be easily adjusted to meet individual needs. The stool should be in oak, the legs being 12" long by 1½" square. They are framed with four top rails, two 15½" long and two 9" long by 2" wide by ¾" thick, and four bottom rails, two 15½" long and two 9" long by 1¼" wide by ½" thick. The top rails are framed in flush and level with the legs, but the bottom rails are framed in quite central. Turned twist stretchers could be used instead of the flat bottom rails, as shown at Fig. 2, their ends being dowelled into the legs. Small blocks screwed in the corners between the top rails (Fig. 3) will greatly strengthen the work.

The leather used for the top should be in strips about 1⅜" wide, six 18½" and ten 12" long being required. The strips are interlaced and tacked to the top rails (Figs. 1 and 3). One end is, fixed first, the interlacing correctly arranged, and then they are pulled up and fixed at the other end. The ends of the strips may be cut square or to a pattern, and a finish is formed with a leather band from ½" to ¾" wide, fixed with ornamental nails.

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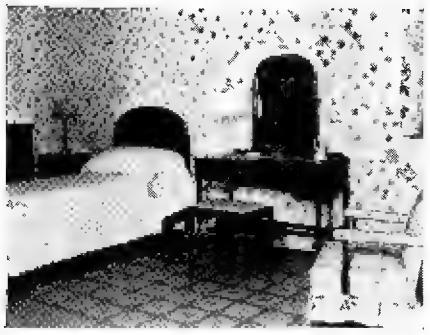
Floors *that* Clean Themselves

Mrs. Frederick discusses the new scientific methods which have made the old-fashioned floor scrubbing and cleaning back-numbers

By Mrs Christine Frederick



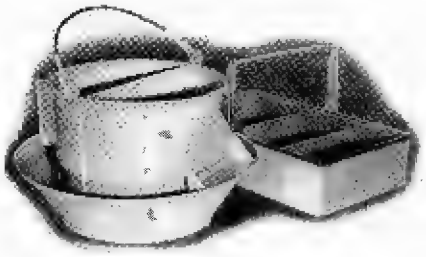
Tasteful linoleum harmonizes with bedroom furniture and decorations, and presents an easily cleaned surface. (W. & J. Sloane)

THE most wearying and undignified piece of work women were ever called upon to do is *floor scrubbing and cleaning*. To this day there are office buildings in New York whose floors are scrubbed by towsled, hard-looking scrub-women, on hands and knees, their hands drenched in dirty scrubbing water in wooden pails almost corrosive with hard yellow soap, full of rosin. But they prove the exception; now we use the expression, "I would scrub floors rather than do this or that," because we feel floor scrubbing ranks with breaking stones on the road—the last work a man descends to.

Once, speaking at a western Farm-Grange meeting, in the years before modern equipment was in general use, I startled the farmers and delighted their wives by a bit of acting. I had been told by these wives that the farmers would not buy modern home equipment. So, dressed in an elaborate evening gown, I suddenly dropped down on hands and knees on the platform in the middle of my lecture, and went through the motions of floor-scrubbing. "Isn't it dreadful to ask a woman to do this kind of work?" I asked from my embarrassing position on the floor; "when modern science makes it quite unnecessary? Do you cut your wheat by hand with a cradle scythe? No! You buy a modern reaper! Why make beasts of burden of your wives?" The farmers blushed to the roots of their hair. Then I rose and showed how the long-handled mops, and other devices, also modern floor surfaces, made the old floor-scrubbing methods utterly unnecessary.

Nowadays we have a higher standard of cleanliness than ever before, but in order to keep it we must first have the right floor surfaces or coverings, and also up-to-date tools. The old soft wooden or board floor, usually painted, is the hardest to take care of, and this was the kind women scrubbed so assiduously, because it never *looked* clean.

They often covered it with some cheap form of oil cloth, which soon was equally unsatisfactory and also constantly called for cleaning. Naturally, not a great many women could afford hardwood floors, waxed, because the waxing process until a few years ago was hard work and expensive. The wax had to be both rubbed on and polished by hand.



The modern pail and tray for cleaning purposes provide partitions for polishes, cleansers, brushes and cloths. (Lewis & Conger)

Now have come marvelous electrical units which scrub, wax and polish by electricity, without requiring any more human energy than a vacuum cleaner in application. They open a complete new era in woman's work and are producing decided changes in construction and floor coverings. When the old type of floor was widespread, women took to carpets, covering the entire floor. Then as wealth grew, we could afford hardwood floors and used rugs. With the coming of the vacuum cleaner carpet cleaning was made easier; women favored carpets again. Remarkable new floor-polishing machines are to be had, so we are having more hardwood floors, kept freshly waxed, and scattered with small rugs which we can lift out of the way easily to apply the floor polisher. Result—mirror-like floors! The whole operation is light work and simple.

Linoleum floors, too, are coming into favor even for bedrooms for they provide a note of color and decoration, and are not as expensive to install as good hardwood. Linoleum may easily be kept in a fine polished, clean state with these automatic waxers and polishers. I personally have linoleum on my living room and dining room floors and find the floor cleaning and polishing problem reduced to a minimum of time and energy. The floor polishing machine will neatly and evenly apply wax (using the new liquid type which helps much to cut down labor), and a moment's shift on the machine to apply the polishing brushes more than equals the strength and energy of ten hausfraus at work. And a woman can do this in a nice frock, standing up, and without fatigue!

Even for occasional clean-up of debris very efficient dustpans with long handles, as well as mops, furnish relief from stooping.

The old mop and scrubbing brush were the first to be changed to the long handle to make their application quite as effective as a brush in the hand of a woman on her knees. Some women always remain skeptical about this, clinging to the idea that there's no cleaning that is really thorough excepting the down-on-hands-and-knees kind. "They're all right for a well-kept floor," they often say, "but what about some of my really dirty floors?" They should see one of these lusty floor polishing machines, with the whirling brushes on. How the dirt will fly!

The *oil* mop is a

(*Continued on page* 1152)

Equip your vacuum cleaner with a sanitary pulp-felt bag which empties through a wide top in a few seconds. It is cheap enough to destroy after each cleaning, but may be re-used several times.

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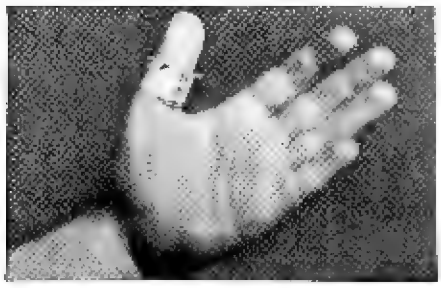
Beauty, Comfort *and* Health *in* New Scientific Devices



Anti-Thumb Sucker

YOU can make Baby cease his favorite indoor sport. Get him this device—an aluminum casting to be attached to the under-thumb with adhesive tape. It allows perfect freedom of movement in eating or playing. . . . But just let Baby try to close his lips over his thumb for a good suck! Cloth tape may be sewed over the tape to prevent the older child from removing the casting.

Pedal the Dust Away

WHY bother with a dustpan and constant bending to get rid of dust and dirt? Just put your foot on a lever in the wall—a spring door will automatically open and you sweep all refuse into a dust chute. The door will close automatically so that drafts will be eliminated. A removable dustbin container is provided. Any danger of fire through spontaneous combustion is eliminated by its all-steel construction.

It's a Table—a Fan—a Heater

AN attractive crinkled dark-brown table for tea, smoking equipment, books or refreshments—and underneath its cover is a coil of wire surrounded by a jacket, an electric fan and a motor. Touch a switch and immediately you get an abundant supply of either heated or cooled air. Because the Thermador ejects warm air in horizontal waves and its fan draws this air back toward the floor, heat centers in the living zone of a room, doing away with floor drafts. It is particularly good for nurseries.

Here's a Beauty Wand!

GIVE yourself a facial massage with an electrically warmed wand. Merely rubbing it over your face will cause wrinkles to vanish. Crows' feet, toothache, neuralgia can be treated at home. A specially shaped bulb attached to the end of a circular bar transmits a continuous unvarying heat. It is shaped to permit rotation inside the mouth or outside, and has been made absolutely safe.

Because of the wand's convenient shape and lack of bulbs it has a wider application than usual heat generating appliances. Just the affected parts and not surrounding ones are reached. The principle upon which it works is simple—through absorption, the wand stimulates cellular activity in rebuilding broken-down cells. Gradually, these are brought back to their normally healthy state.

For a Literary Cook

HOW'D you like to grill some steak? Make a welsh rarebit? By merely removing this lampshade and inverting the base, you may cook, fry, toast, and at the same time, take the chill out of the room. You get an asbestos pad with each outfit. Safety is guaranteed, for the projecting grill switch prevents the heater's being used in a downward position. If you desire, the light may be turned off while the grill is in operation. Or toast may be kept warm placed under its rays. The lamp itself is regulation size, 16 inches high. The grill is rated at 600 watts. Either direct or alternating current provides its power—the same current as for your ordinary lamps and lights. It can be used in almost any room of the house—sick room, nursery, dining room, kitchenette. The lamp has a crystallized enamel finish; the shade is of parchment or silk.

Names and addresses of manufacturers gladly supplied upon request.

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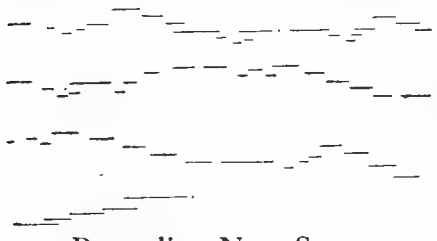
WRINKLES

$5 First Prize

Your Attic Garden

AN indoor hotbed can be very easily made in your attic—particularly if it has a dormer window on the south with a brick flue nearby. Early plants that require careful watching may be planted here and transplanted into the garden when they sprout an inch or two. There is no danger of their being frost victims on a cold spring night. Lay some boards over the ceiling rafters around the flue and build two or three boxes there. Tarred building paper laid on top of the boards will eliminate moisture reaching the ceiling plaster underneath. Partially fill the boxes with wet earth and plant close rows of seeds.

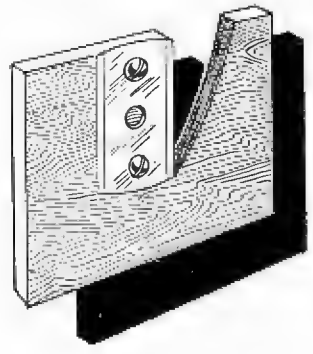
D. V.



Recording New Songs

TAKE any slip of paper and jot down marks to represent notes, when you hear a catchy tune. Make long marks for long notes, short marks for short ones. Place them under and above, as sketched, to indicate their relative position on the scale. This system can be employed in the dark.

J. C. Pratt.



A Twine Cutter

FOR cutting twine at home or at a wrapping counter, take a piece of thin board and cut as illustrated. Insert a double-edged safety razor blade, allowing a protecting piece of wood over the edge of the blade. Screws may be turned through the holes of the blade and attached to any convenient place.

Vernon V. Johnson

To Remove Iodine Stains

THE annoying brown stain of iodine, or the blue color it forms with starch may be instantly removed by dissolving some sodium thiosulphate in water, and treating the spot with this solution.

Arthur Stickler.

Dry Cleaning Clothes

TO clean dirty clothes without washing, rub them with a mixture of ammonia and Fuller's Earth. Rub off with a dry, clean rag.

Seavax Framroze Desai.

To Make Indelible Ink

TO make indelible ink that cannot be erased without destroying the paper, add a strong solution of prussian blue in distilled water to gall ink. The color of the ink will be a greenish blue, but will turn black. Benjamin Heller.

Keeping Brushes New

TO keep paint brushes fresh and new, regardless of the paint used, dip the brush into a can of linseed oil, after thoroughly cleaning it with common benzene or kerosene. Then wrap it in newspaper. The hair will remain clean, soft and pliable. Henry Kacinsky.

Repairing Tiles

WHEN a piece of tile falls out of the wall and breaks beyond repair, you can replace it with a substitute that will look like another tile. Fill the hole with white plaster molded to the shape of the original piece. Give it a few coats of water glass.

Frank Schmulowitz.

Keep Clocks Clean

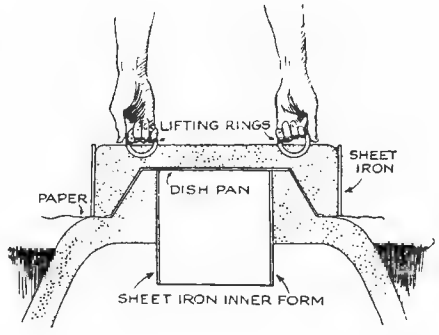
DIP a piece of absorbent cotton about the size of an egg in kerosene. Place it in the bottom of the clock and shut the case. The fumes of the kerosene will loosen the dirt particles of the machinery, which will fall upon and thus be automatically collected in the cotton. Remove the dirty cotton after a few days.

Seavax Framroze Desai.

A Clean Windshield

RAIN and sleet make it almost impossible to see through the windshield of a car. Rubbing a little of the following compound over its outside surface will prevent all streaking. Shave some white soap with a knife (preferably Ivory Soap). Add 4 or 5 drops of glycerin and about the same amount of water—enough to form a smooth paste.

Arthur Stickler.



A Fool-Proof Reservoir Cap

THIS was used for a cistern, which was brought up to the top of the ground by plastering with three thick coats of concrete and a little lime directly to the walls of the excavation. Temporary forms were put in place and for the inside form for the neck a sheet of galvanized iron was used as shown. Soft concrete was packed about this up to the top and then a tin dish pan was forced over it upside down and turned first this way, then that, to smooth the surface. By lifting off several times any air spaces could be easily filled in with concrete again. Strips of paper were then placed as shown and a wide strip of sheet iron bent to form a low cylinder was made for the outer form for the cap. This was set in place with strips of paper underneath to prevent the concrete of the cap from bonding with the concrete of the cistern neck. It was then filled in with concrete to the top and two iron rings inserted for lifting purposes. The top was smoothed off, then the whole job was left for several days to cure.

When cured, the cap was first lifted off, then the pan came off, exposing the opening of the cistern. The pan was not damaged.

Dale R. Van Horn.

RUBBER BAND MAKES AIR-TIGHT SEAL FOR CANS

Sealing Tin Cans Hermetically

A WIDE rubber band, stretched taut, put about the can with the cover in place, so as to overlap, provides an excellent air and water tight seal. It can be used for experimental work or sealing cans of food stuffs, and is instantly removable. An old inner tube will furnish the band for a large can.

Dale R. Van Horn.

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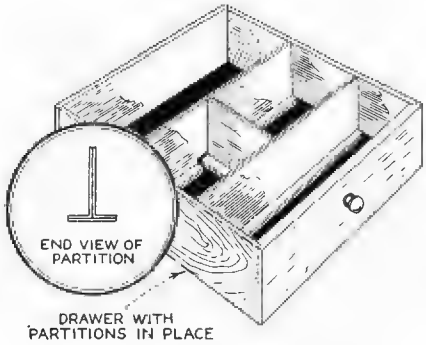
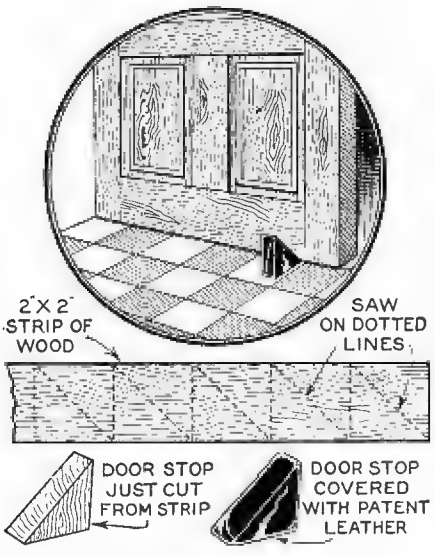
and RECIPES



Divisions for Drawers

CUT two pieces of cardboard the length of the drawer and about one inch deeper. Paste them together, with the bottom edges folded backward. Glue to it a piece of cardboard the size of the bottom of your desired partition. If you cover these drawers with cretonne, oilcloth and a final coat of shellac, they will be sanitary, durable and decorative. Binding the edges with colored gummed-linen binding tape will add a finishing touch.

NANKI FIELD.



Make Attractive Door-Stops

TAKE a 2x2 inch strip of wood and cut blocks from it on a 45 degree angle. Cover with patent leather or other durable material.

EUGENE D. YATES.

Digging Holes With a Hose

When laying pipe under ground and it becomes necessary to go under a sidewalk, do not tear up your sidewalk but use the following method: Take your garden hose and fasten a piece of pipe on it about ten feet long. Turn on the water and start digging with it. The water washes the dirt away so fast that it will surprise you how fast you can get under a sidewalk. This is much better than digging with a shovel and it does a better job.—*T. G. Cady.*

A Permanent Label

IF you want a waterproof label for a bottle, one impervious to all handling, why not apply the label and then give it a coat or two of shellac?

FRANK SCHMULOWITZ.

Cement for Glass or Cork Stoppers

A good cement for glass or cork stoppers can be made by mixing lead oxide (litharge) ¼ oz. and concentrated glycerine ½ oz. Paint this around the glass or cork stopper on the bottle. It soon dries and becomes hard. It may easily be scraped off when necessary to open bottle.—*Benjamin Heller.*

Some Handy "Kinks"

FINGERNAIL Polish Remover is a much quicker and more complete means of removing lacquer from the hands than lacquer thinner. Also it does not burn the hands as the thinner does.

TO clean light-colored felt hats, mix salt and cornmeal in the proportion of 1 teasp. of salt to 2 tablesp. of cornmeal. Place hat on a paper, and rub briskly with the mixture, using a soft cloth. When the mixture looks dirty, brush the hat thoroughly with a stiff, clean brush and you will find a marvelous change in your hat.

TO size rugs, thoroughly clean and dry, then place on floor, upside down. Stretch to right size and then tack on all four sides, using plenty of tacks. Take 50 cents worth of powdered glue and dissolve in a quart of lukewarm water. When thoroughly dissolved, stir in 4 quarts of boiling water. Apply to back of rug with an old broom and leave tacked down till dry. Above recipe makes enough liquid for a 9 x 12 rug.—*Mrs. H. E. Chrisman.*

DIFFICULTY is always encountered in plucking small stubs and feathers from chickens. An ordinary pair of eyebrow tweezers is an excellent instrument for this purpose.—*Alyse Hoffman.*

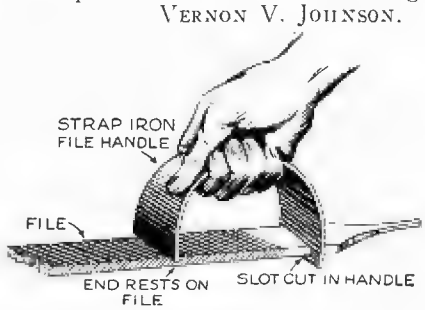
$5.00

will be paid each month for the best wrinkle or recipe submitted to the editors and which they accept and publish in these columns. All other ideas accepted and published in this department will be paid for at regular rates. Address your ideas to—*Editor Wrinkles and Recipes.*

An Inkwell Stopper

AN ordinary marble placed over the opening of an inkwell of the type sketched will prevent the entrance of dust and flies. It is easily rolled aside and so presents no obstacle to writing.

VERNON V. JOHNSON.



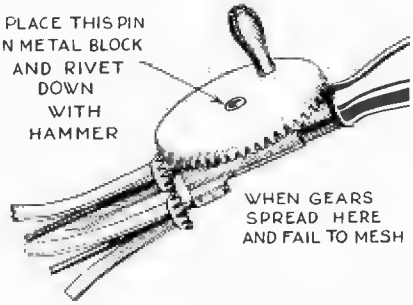
Make Your Own File Handle

GET a strip of medium-weight strap iron 5 or 6 inches long and bend to form a "U", with one side half-inch longer than the other. Rest the shorter side on the upper file surface, and fit the file point through a slot made in the long end.

D. R. V.

To Fill Plaster Cracks

USE vinegar instead of water in mixing your plaster of paris. The resulting mass will be like putty and will not set for twenty or thirty minutes. If you use water the paris will set before you can readily apply it. Push this into cracks and smooth off with table knife.—*A. H.*



Repairing the Egg Beater

THE gears on egg beaters often spread and fail to mesh. To repair, simply place the center pin or axis of the large gear over a piece of metal and rivet the head tighter with a few taps of the hammer.

HI SIBLEY.

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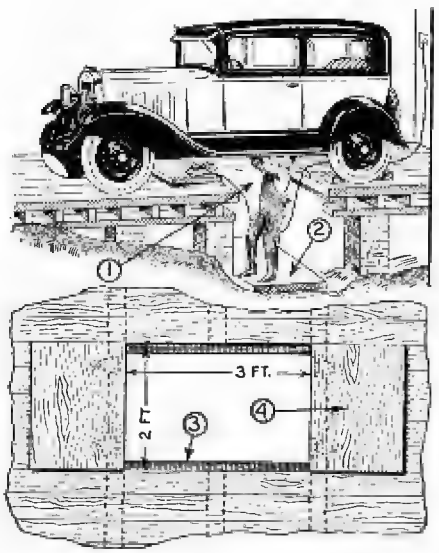
HINTS *for the* MOTORIST

Timely Tips for the Owner and Driver

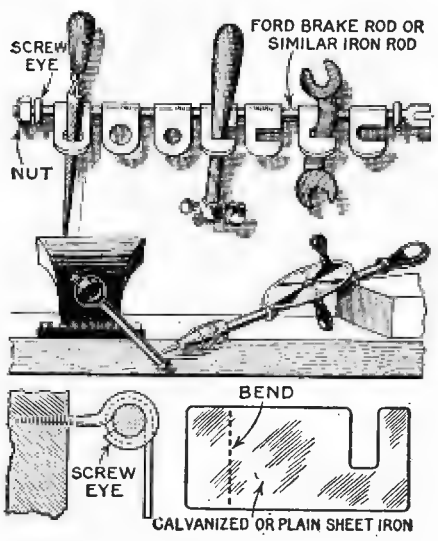
Make Your Own Repair Pit



A FRAME garage may be altered to give all the advantages of a pit, and without the disadvantages. An opening is made through the floor, about two feet by three feet, and is framed around with hinged covers of heavy oak. A platform under this affords a working space for the owner, and a place to set tools and parts. This pit substitute is clean, well ventilated and can easily be made in an hour or so of spare time.

Rack Your Tools on an Old Brake Rod

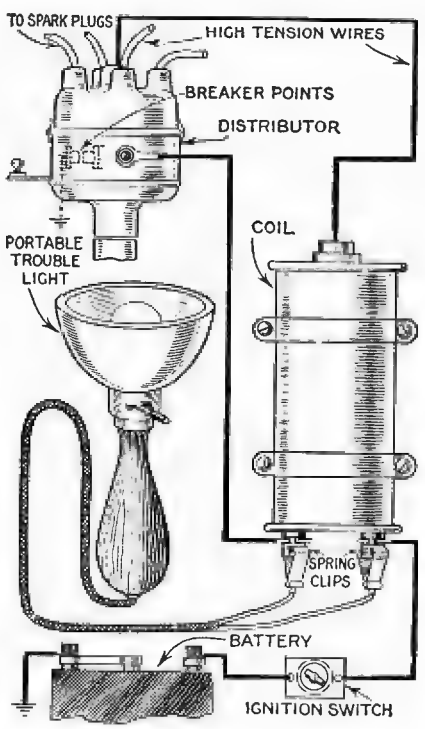
THE garage work bench will be more useful for spring-time work if an orderly arrangement of the tools is provided. About eighteen inches above and directly to the rear is a tool holder made of sheet iron hangers on an iron rod. Some hangers are fitted with circular opening for such small tools as files and screw-drivers. Open side hangars provide for larger tools as drills, wrenches and hammers. This arrangement makes every tool available instantly without lost time in searching around boxes or drawers.



DO YOU KNOW—

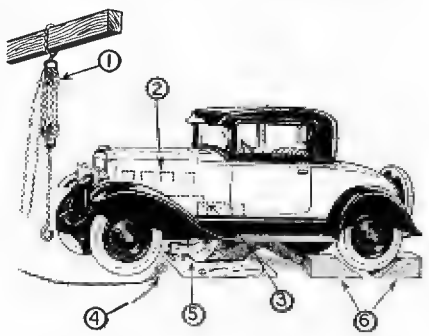
play in spring shackles causes side sway and wheel "shimmy"? Adjustment is provided for the shackles on all the springs and this adjustment should be used when shimmy or unsteady steering occurs.

Test the Distributer with a Portable Light



A SURE and certain means of testing the ignition is by means of an electric light in circuit with the distributer. The spring clips of the portable car light are attached to the terminals of the coil, which connect to the distributer and the switch. When the car is run slowly or the motor is turned over to the starter, the light flashes for each contact of the breaker points. A miss due to faulty parts, lost motion in the breaker or other cause, is immediately evident. Where this test shows no defects, the one remaining item in the ignition circuit which must be at fault is the coil, which should be subjected to an independent test.

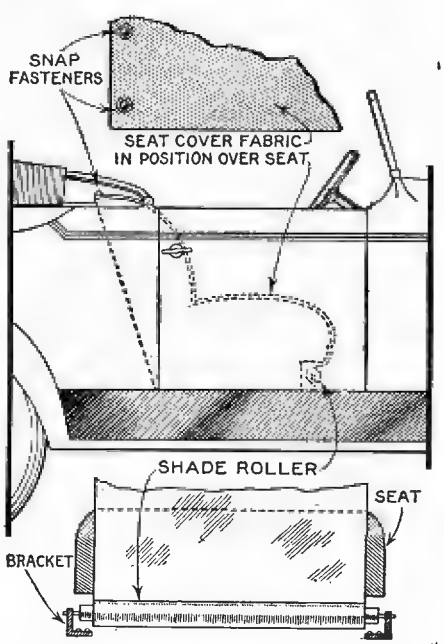
Safety Hints for Repair Work



HERE are several important precautions for car repair work. One, disconnect a lead from the storage battery while working. This prevents anyone from starting the engine. Two, use blocks under a wheel, to avoid the axle toppling off a jack. Three, watch out for gasoline. A broken extension light may produce a spark which will ignite the gasoline. Four, do not hold the head directly under the work in hand. Dirt in the eyes, or a slipping wrench striking the face, may result. Five, use gloves as far as possible when handling piston rings. Ugly cuts can result from sharp edges. Six, take no chances with light chain or rope garage hoists. Seven, put good blocking under the raised axle.

Keep Dry in the Open Car

AN ingenious means for providing dry seat covers for the open car is the application of waterproof seating-cover from a shade roller. Small snap fasteners, as used for curtains, hold the upper edge in place.



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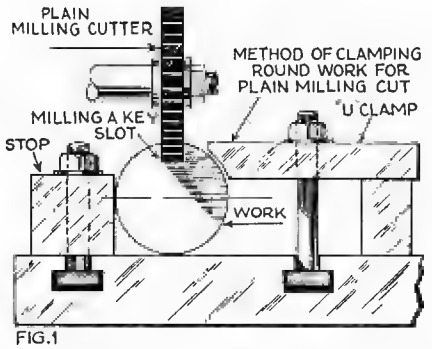
Tips *for the* Young Machinist

Plain, Side and Angular Milling Machine Work

By George A. Luers



Here is an easy method for milling a key slot.

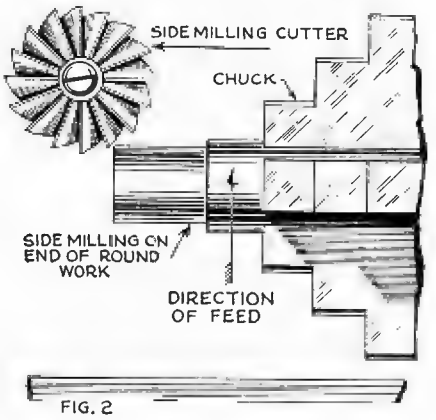
Milling a Key Slot in Round Stock

IN the set-up for this job it is necessary to support the shaft against rotation or end movement. This is accomplished by bolting a stop on the milling machine bed, placing the work against this and using a clamp on the side opposite, so that the pressure of the clamp will force the work against the machine bed and also against the stop. The table feed moves the work along the circumference of the cutter, while the width of cut is varied by adjusting the table sidewise.

Cutting a Polygon with a Side Mill

TO mill a square or any other polygon, a hexagonal bolt head for example, the quickest method is to place the job in a jaw chuck having a circular feed and graduated for spacing.

In Fig. 2, an example of milling squares on the end of circular stock, hold by a chuck bolted to the milling machine bed, is shown. The work is fed up by moving the machine bed with the vertical feed screw. Each side is cut, until the four faces have been machined. Measurements are made for size and the second cut is made, continuing until the correct size is obtained. Using this method, the side mill makes the shoulder even and square with the flats.

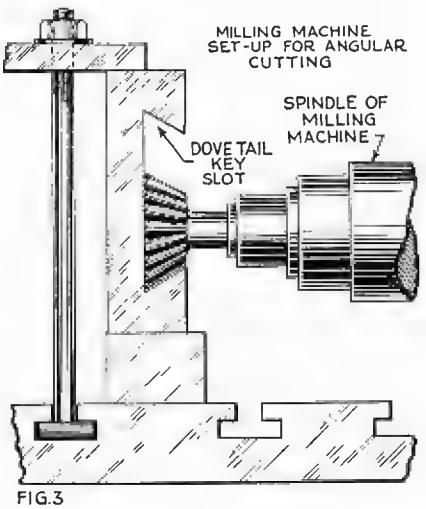


A square or hexagonal bolt may be easily milled in the above manner.

Angular Mill for Dove-tail Slots

IN the cutting of various key slots, with angular engaging faces, only angular cutters can be used. Of course, it is possible to shape a similar slot on the shaper; however, the milling machine will give the most accurate job.

Fig. 3 shows an example of cutting a dove-tail slot. The angular mill for this job is usually either a 60 or 45-degree tool. The space between the two angular sides can most frequently be cut out quicker by plain milling, or at least the most of the metal can be rough cut to leave only a small amount of metal to be removed by the angle cutter.

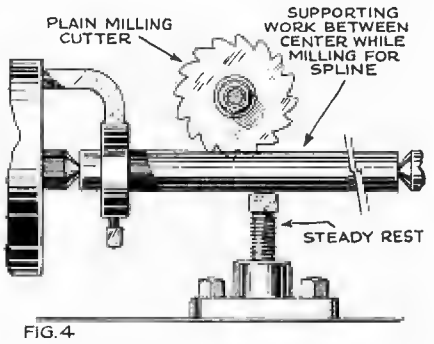


A simple means for milling a dove-tail slot is given here.

Shaft Splining Supported by Centers

A JOB frequently required of the milling machine operator is that of splining or cutting a key slot the length of a slender shaft.

A set-up for doing this job is shown by Fig. 4. In this work one or more steady rests are placed under the shaft to prevent the part from springing away from the tool. The work is held between centers and a dog prevents rotation. Light cuts are taken to prevent deflection of the shaft. Measurements are made before removing the job from the machine, and if the depth of cut is deficient additional steady rests are placed under the shaft. The tool is again cut through the slot.

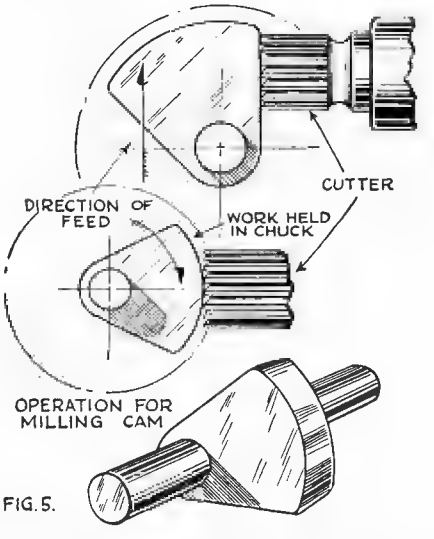


This is the way to spline a slot in a slender shaft.

An Easier Way to Cut a Cam

IN the illustration shown by Fig. 5 is a common type of cam. The work is lathe turned first, and before milling appears as a shaft with a disk at the center.

To mill this the work is held in index centers and a side cutter or end mill used. The sides are milled by use of the table feed and finally the surface next to the hub is cut, using the index center feed. In this job the operator must plan to set the work up, so that the vertical and horizontal movements of the table and the index head of the chuck or center will bring the work in correct relation to the tool, as the tool cannot be moved to the work.



Cam milling is not difficult when done in the above manner.

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THE SAFETY

Conducted by

Readers' Opinions and Comments

A Perpetual Motion Watch?

I RECENTLY bought a wrist watch which is marked "Harwood, selfwinding watch, Swiss made." The dealer says that the

watch keeps on moving forever, provided I do not put it aside over 24 hours.

Will you please explain the mechanics of the watch? Is it perpetual motion?

W. K. Lee,
Penang, China.

(*The selfwinding watch is not perpetual motion. It operates substantially the same as an ordinary pedometer. In a pedometer there is a weight suspended by a spring. This weight moves down at each step because of the concussive blow produced by the heel of the user's feet. This pendulous movement operates a wheel, geared to the indicating hand and shows on the dial how many miles the individual has walked. In the case of a watch, a similar motion is produced, except that when a person walks, he swings his arm back and forth and this swinging motion causes the spring in the clock to be wound up. If the person kept his hands in his pockets or set the watch aside for 36 hours, it would fail to operate until again worn. Wearing the watch four hours will wind it for 36 hours.*—Editor.)

Special Contests

REFERRING to the suggestion of J. G. Q. in the January number, I think it is an excellent idea. Scientific apparatus, to carry on his experiments would lure every amateur into putting forth his best efforts. Naturally much benefit to all concerned must result.

The co-operation of manufacturers of this apparatus could no doubt be secured and the expense of such a contest much lessened.

However, I must differ with your correspondent on one or two points. In the first place, instead of one Big Prize, I would advise several smaller ones to be apportioned somewhat like this: First Prize, value about $100.00; second, $75.00; third, about $50.00 to $25.00; then five or ten prizes amounting to about $10.00 or less, such as books, small outfits, etc.

My second objection is to his set of questions. The terms he sets forth are all right in a contest of experts, but this one is inaugurated to aid the general student and amateur; therefore, I suggest that a more general and comprehensive knowledge of the underlying principles of the several sciences be required.

Nevertheless, I leave it up to you to settle these differences in the way you see fit. The one big issue is the starting of these contests, so let's go!!!

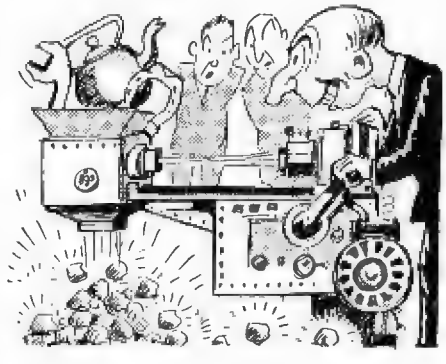
Science and Invention, as usual, is leading the field in this matter which is surely giving science the biggest boost it has had in a long time.

E. W. Smith,
Ottumwa, Iowa.

(*In the January issue J. G. Q. made a suggestion that* Science and Invention *Magazine conduct contests on such subjects as bacteriology, chemistry, pharmacy, mathematics, physics, electricity and so on. Judging from the comments, it would not seem that such a series of contests would be of interest to the average reader. The majority would rather have articles by authorities and duplicate the experiments outlined than compete against authorities for prizes.*—Editor.)

Making Gold!

IN the New Zealand "Truth" published on September 19th, 1929, an article appeared concerning the manufacture of gold by the chromadyne process, sponsored by the Christchurch syndicate. This publication challenged the syndicate to give a demonstration before scientists of repute. Being a chemist, I was naturally curious in first learning of this remarkable and seemingly improbable process. Chromadyne is supposed to be a new ray that transmutes the elements used to gold, in accordance with the statements of the inventors. It seems remarkable, if the process is a hoax, that Dr. Marsden should be given a demonstra-



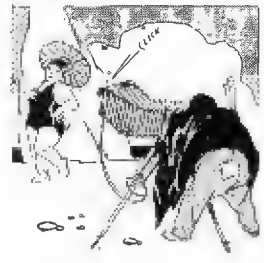
tion of the method, as he is essentially a government official, being the Secretary of the Department of Industrial and Scientific Research, and a physicist. The news clipping states that he returned with samples of the chemical and the gold allegedly made by the secret process. What do you think?

F. Bishop,
Wanganui, New Zealand.

(*So many different systems for the making of gold from baser materials have so repeatedly hoaxed the public that any scientific proof would have to be convincing to more than one man, even though he be an official governmental physicist. We do not believe that the New Zealand "Truth" will have any difficulty in upholding their position. Gold has not yet been made by any process either by mixing chemicals or acting on chemicals by some unknown imaginative ray.*—Editor.)

Likes Movie Articles

I HAVE purchased quite a number of copies of Science and Invention at newspaper stands and think it A1. I am very much interested in the articles by Don Bennett on "Movie Making" as I am planning to purchase a camera in the near future. I take quite a number of still photos and have a very good collection of them which I took during my travels as radio operator on various vessels. His articles show that he thoroughly understands the topic he writes about and are very helpful to the fellow who is starting in with his camera.



R. Madden,
San Francisco, Calif.

We Stand Corrected

I WAS interested in "An Intricate Problem" on page 919 of the February issue of Science and Invention, and submit an answer.

The circumference of the earth at the equator in feet is equal to πD, where D denotes diameter in feet. The length of wire suspended 6 feet above the earth's surface in feet is equal to $\pi(D + 12) = X$. This is equal to $\pi D + 12\pi = X$. X denotes the length to be found. Then $X = 25{,}000 X 5280 + 12\pi$. (You gave the value of the circumference as 25,000 miles). The stretched wire is therefore 12π longer than the circumference of the earth which you gave. Since you state the value of π to be 3.14159, the extra length of wire would be 12 times this figure which is 37.69908 feet. The analysis proves that the value of the extra length of wire depends entirely on the numerical value assumed for π. With π as 3.141592653589793 we would get 37.699111-843077496 additional feet of wire required.

Professor F. E. Austin,
Hanover, N. H.

(*We wish to thank you and the many other readers of* Science and Invention *Magazine who found this problem so fascinating, for their deluge of answers simplified the editor's mode of calculation. Hence a difference of slightly more than one and one-half ten thousandths of a foot less than the amount of wire that should actually be used. We wish to thank our critical audience for not letting us get away with even such a small error.*—Editor.)

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VALVE

Joseph H. Kraus

Will Be Welcomed by the Editors

Piles Them Up

I FEEL I must write and thank you for the splendid design of lantern type floor lamp article No. 8 of the Wood Turning Series, which I have just had the pleasure of finishing. Owing to my being unable to obtain the size of the material as specified, I adopted the method of gluing many smaller pieces of wood together. This may be of interest to others desirous of making a lamp under similar conditions.

Needless to say, you have another regular reader of SCIENCE AND INVENTION.

E. DURLING,
British Columbia, Canada.

It Moves When It Doesn't

I HAVE been following with interest your articles on "Relativity and Common Sense." They have stimulated me to do a little thinking of my own. As a result I have been struck with an idea that is puzzling me. I would like you to try to explain it.

Hitherto I had always thought of space and time as being infinite; that is, never ending. When I speak of space, I do not mean inhabited space necessarily, but rather just space in terms of three dimensions. Whenever I would try to set a limit to space (or time), I would always tell myself that more space (or time) must exist after that. So this theory satisfied me for some time.

But one evening last week, someone asked me the time. It happened to be one minute before nine o'clock, so I told him it was nine o'clock. And then the idea struck me that it could never be nine o'clock. As the minute hand moves toward the twelve mark, the fraction of the minute before the hour slowly decreases. But there always remains a fraction of a minute before the twelve mark is reached, however small it may be. True, it steadily decreases, but assuming our system of numbers to be infinite in length, there always remains a small fraction of time to be "overcome" before the hand reaches twelve. This leads to the conclusion that the hand never does reach the twelve mark! Or for that matter we can say the hand does not move at all, for it must move an infinitely small fraction of a minute before it moves at all. Since this fraction is infinitely small, we may say that it does not move at all. But with our own eyes we see the hand move and we see it pass the twelve mark.

Either our system of "counting" is wrong or space and time are purely man-made terms. If the first be true, we cannot measure space nor time; therefore we cannot say that they are infinite. If the latter be true, well there is no use thinking about anything that exists only in our imaginations. At any rate, I am very much confused and would like to be straightened out.

DANIEL DAVIS,
Library, Pa.

(The question that puzzles you is as old as Greek philosophy. Unfortunately, I haven't the library facilities to refer you to the original sources, but your problem is closely akin to the following:

A fox is chasing a hare. Though his speed is greater than that of the hare, the argument always pops up. "As he approaches the hare, the distance between them decreases, but there will always remain a small distance that will never be covered."

The fox in the above story is the minute hand of your clock, chasing after the "hare" hour hand. Since we both know that the fox catches the rabbit, we must try to discern the fallacy in our reasoning.

Our figuring, in the above, amounts to dividing the small space that separates the fox and the hare into an infinite number of pieces almost zero in length. From the fact that the number is infinite we have concluded that the total time necessary to travel the total distance is infinite. Here is the fallacy. When we divide a space into an infinite number of pieces, each one becomes infinitesimal in length, and therefore, it may be traversed in infinitesimal time. Just as the infinite number of infinitesimal spacial lengths sum up to a finite distance, so the infinite number of infinitesimal moments sum up to a finite interval of time.

PROFESSOR DONALD H. MENZEL.)

The Egg In The Bottle?

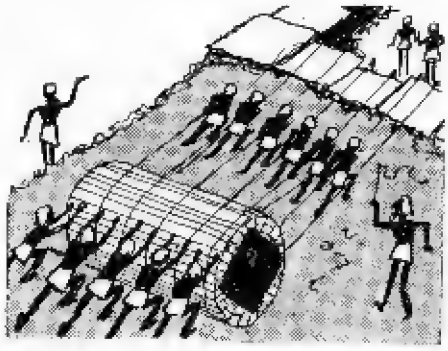
PLEASE reveal to me the trick of putting an egg in a small size bottle without breaking it. I first saw it in Ripley's "Believe It Or Not." He says, soak the egg in vinegar until the shell has become soft, then squeeze it in the bottle. I have done this with about a dozen eggs, but it will not work. The shell will become soft all right, but just try to get it into a bottle without breaking it. I have filled the bottle with hot water to create a vacuum by pouring it out quickly, and this will not work either. The suction always bursts the egg. There is some detail left out. It can be done I know. I feel sure you people can solve the trick.

JOHN D. T. DAVIES,
East Palestine, Ohio.

(The mouth of your bottle is too small. Soak an egg in vinegar until the shell becomes soft; then take a candle and drop it into the bottle so as to burn up the oxygen in that bottle, and in addition heat the air; and then if you will place the egg over the bottle, extinguishing the flame, you will find that the egg slides into the bottle nicely. The hot water system will work.—EDITOR.)

How Pyramids Are Built

IN the October issue of SCIENCE AND INVENTION I have read about the building of the Pyramids which are counted as one of the wonders of the world.



I do not think that they were built in the way some reader suggested; *i.e.*, by navigation, etc. In those days these great engineering feats were done only by man power. My suggestion is:

First of all, those builders put a very strong foundation on all four sides, say up to a certain height. Then they put useless pieces of stone, earth and other rubbish alongside the wall of the foundations and made an inclined road. Then on that road they dragged the big, huge stones by means of ropes, etc., and placed them on the foundation. Then in the similar way again they raised the inclined road and put the third and fourth layers of stone and hence finished the pyramids. This is how some of our very big stone temples are built in Southern India.

S. N. GADAG,
India.

(A long mound of dirt was undoubtedly the mode of aiding construction that was used in the building of the pyramids. It was not essential that the mound be built of rubbish when it was so easy to build up the mound with the material available at the time and then permit the winds to destroy the mound. The only other method that could possibly be used without very great inconvenience would have been to haul the large stone slabs on rollers, up the sloping sides of the pyramid. Most authorities conclude that the ramp system was the most practical.—EDITOR.)

Bunk?

ON page 850 in your January number you offer $21,000.00 for spirits. Is this a bonafide offer or just another Dunninger trick? It occurs to me that Mrs. Harry Houdini paid Arthur Ford of New York $10,000.00 because said Ford correctly gave the lady the message Houdini and wife wrote out and deposited in a lock box. Now if you are so mighty in earnest about spirits, read up on what Dr. L. R. G. Crandon and Mrs. Crandon (Margery) have produced these last five years, address 10 Lime St., Boston. They now are in England and were

(Continued on page 1157)

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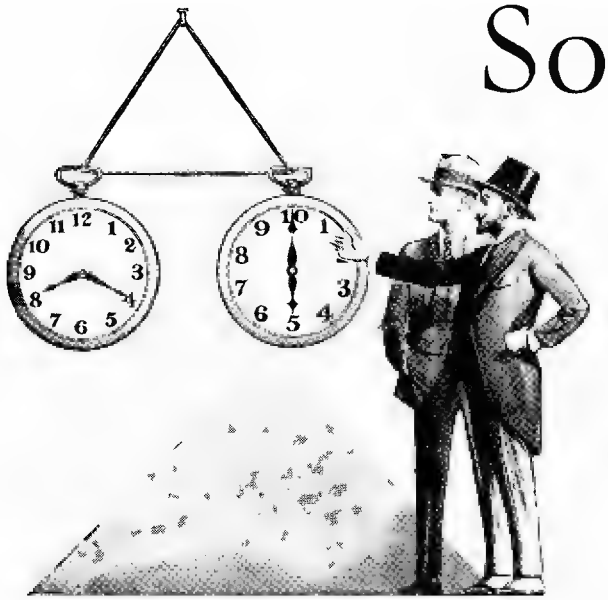


Solve *these* Brain Teasers *and* Win *a* Prize

By Sam Loyd

A Question of Time

THE Puzzle King presents the fourth of a series of problems the solving of which show if your mathematical ability is bolstered up by logical reasoning. Prize winners of the January puzzles will be found listed on page 1141.

A FRENCH advocate of decimal divisions in our weights and measures says he is going to improve upon our old Babylonian method of dividing time, by inducing mankind to adopt his ten-hour clock. He divides the day into ten hours, each hour 100 minutes, and each minute 100 seconds.

The sketch shows how this decimal timepiece would appear at the noon hour. The hour hand travels once around the dial each day, the minute hand going ten times as fast; so you see, five o'clock decimal time would be twelve o'clock noon on the regulation clock.

The regulation clock in our sketch shows the hands as usually presented on the signs swinging in front of jewelry shops. The hands are at equal distance from 6, and the time is something in the neighborhood of twenty minutes past eight.

Here is our problem: If on the regulation sign clock the time is a. m., how would you translate that exact time to the decimal clock? In other words, what would it be in decimal time?

Twenty-five Dollars in Prizes

A FIRST PRIZE of $10 will be awarded to the person sending correct answers to the two puzzles *accompanied by the best expressed analysis of the Time Problem.*

A SECOND PRIZE of $5 will be awarded for the next best analysis and correct answers to the two puzzles.

TEN PRIZES of $1 each will be awarded to the ten persons who send the next best analyses of the Time Problem, together with correct answers to the two puzzles.

Answers must be received not later than noon, April 15th, addressed to "Puzzle Editor," SCIENCE AND INVENTION, 381 Fourth Avenue, New York City.

All contestants must abide by the decisions of Sam Loyd, who will examine all papers and award the prizes.

Papers of identical merit, tying for any one of the prizes, will each receive the full amount of the prize tied for.

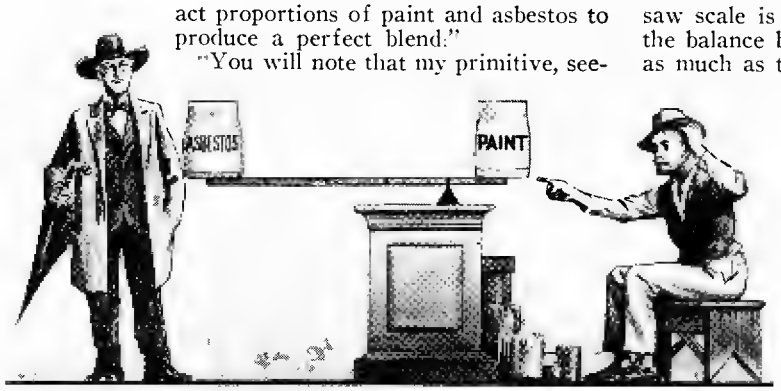
Mixing Paint

I DISCOVERED Keegan, our village paint merchant, mixing up a quantity of his popular fireproof paint.

"This is really a very scientific concoction," I was informed by Keegan, who readily admits that he is considerable of a chemist.

"Yes," he continued, "it took twenty years' of experimenting before I hit upon the exact proportions of paint and asbestos to produce a perfect blend."

"You will note that my primitive, see-saw scale is in perfect balance. Now, the balance bar, which weighs one-half as much as the bag of paint, has four-fifths of its length on one side of the fulcrum, or balance point, so let me see you figure out the weight of that asbestos, just the quantity to mix with that 10-lb. bag of paint."



Keegan's proposition is fair, so let us tell him how much asbestos he blends with a 10-lb. bag of paint.

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MAGIC

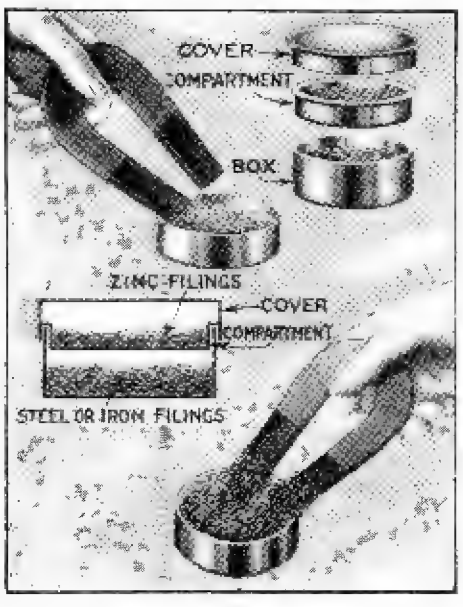
By Hennigar

No. 80 of a Series

The Plate Eater

THE magician patters about East Indian tribes who feast upon stones, metal and the like. He picks up a large white china plate, and without hesitation, apparently, bites off a large piece. The action produces a loud snap as though plate breaks. The magician then seems to swallow the piece chewed out and holding the plate in front of his stomach, he rubs the missing section with his fingers whereupon the plate is once again mysteriously restored to it original form. Secret: An irregular flat piece of metal is slid over the edge of the plate just before the magician puts the plate into his mouth. This makes it seem that a piece has been chewed out of the plate when the latter is held in front of the coat. The snap is produced by clicking a coin against the back of the plate, and restoration, by palming the metal piece.

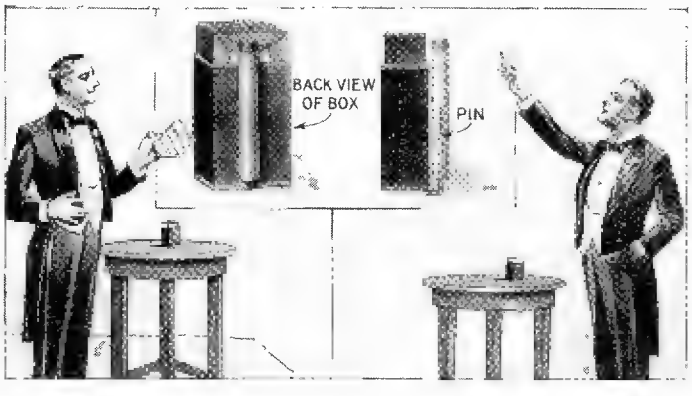
Magnetic Control



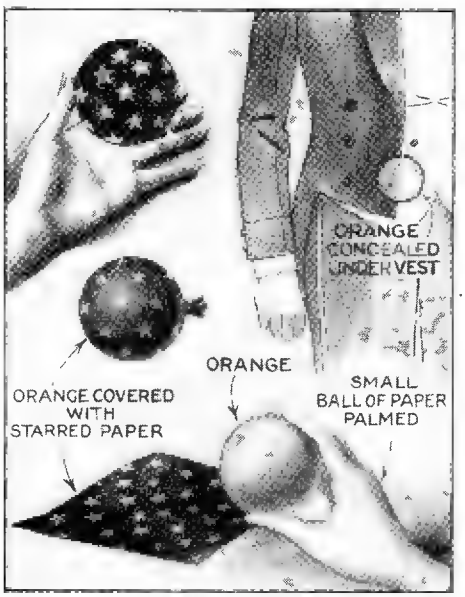
A HORSESHOE magnet is passed for inspection. The wizard then hands members in his audience a small pill-box filled with metal filings. Strangely the metal filings are not attracted to the magnet. The magician then passes his hands over the steel, and plunging it into the box he causes the metal filings to adhere to it. Secret: The magnet is of the ordinary variety, the pill-box is double. The top compartment contains zinc filings; the bottom compartment used by the magician contains steel or iron filings. The spectators test the first compartment. The magician uses the second.

Phantom Cigarettes

THE magician, feeling desirous of smoking a cigarette, reaches for his case and finds it empty. Pushing the drawer of a match-box open, he discovers that this too is empty. Someone is sure to remark that he, being a magician, might produce one from empty space, or the magician can assume that he heard such a remark, forcing the words upon the lips of one of the audience. Reaching into the air, he produces a burning cigarette. Secret: The cigarette case and match-box are purposely left empty so as to give the performer an opportunity of doing the trick. Actually, a lighted cigarette is supported behind the match-box, on a bent needle or pin protruding therefrom. When the magician picks up the match-box he gains possession of the cigarette. The cigarette can be concealed until the very instant of its production from the trick match-box.



Mystic Ball



THE magician passes a sphere for inspection. This proves to be a black ball decorated with gold stars. Returning to the platform, he bares his arms to the elbows, rolls the ball between his palms, and when again displayed it is found to be an orange. Secret: The ball itself is the size of an orange and has been decorated to conform with the pattern on black paper, which is used to cover an orange concealed beneath the vest. The ball is substituted for the orange and the paper is removed under cover of the palm.

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Let's Laugh

ALL jokes published here are paid for at a rate of $1.00 each; $3.00 is paid for the best joke submitted each month. Jokes should be scientific. Write each joke on a separate sheet of paper and add name and address to each sheet of paper.

SURE CURE

The druggist instructs his new clerk: "See this bottle? This is what we always use for filling prescriptions which we cannot read."—*L. Lansberg.*

FREE-WILL OFFERING

A farmer's wife shipped a crate of eggs to a wholesale house in a city, but before doing so she wrote on one of them: "I got 2 cents for this egg. What did you pay for it?" And she added her name and address.

A year later she received an answer. It was written on the highly embellished stationery of an actor. "My dear madam," he wrote, "while playing the part of Hamlet, out West recently, I received your egg for nothing."

—*Mrs. H. E. Chrisman.*

TOO TRUE

TEACHER—What is the mechanical advantage in having a pump with a long handle?

FRESHMAN—So you can have someone to help you pump.

—*Ruth H. Johnson.*

ONE GOOD TURN——

PILOT (to lady inspecting his plane) — And this, madam, is the motor.

LADY—But if its fastened like that, how can it turn over?

—*Floyd E. White.*

INFANTS DON'T KNOW THE DIFFERENCE

FLAPPER—Mother, the nurses in the hospital here are worse than thieves! I've seen two mixing water with milk for the babies' bottles.—*H. Freeman.*

THE CUT-UP

First Prize $3.00

HE (twice nicked by the razor) — Hey, barber, gimme a glass of water.

BARBER — Whatsa matter, hair in your mouth?

HE — No, I wanna see if my neck leaks.

—*Jerome Kukla.*

GREAT SANDWICHES

MANDY—Must I give Rastus one of dem musta'd plastahs again today, doctah?

DOCTOR—Yes, Mandy, I think you had better.

MANDY—Whell, he says to ox yo' kin he have a slice of ham wid it, to kill the taste. —*J. Tallarico.*

THIS BURNS ONE UP

BOOB—It's a lye.

BIGGER—What's a lie?

BOOB—Potash.

EDUCATION

MRS. GOTTRICHQUIKK (to visitor)—Yass, our little son Jamie is learning French and algebra, you know. Jamie, tell the lady how to say "Good morning" in algebra.

SPLENDID YARN

CLERK (showing customer golf stockings)—Wonderful value, sir. Worth double the money. Latest patterns, fast colors, hole-proof, won't shrink, and it's a good yarn.

CUSTOMER—Yes, and very well told.

—*Mildred Taylor.*

QUITE RIGHT

MARY—I have a cold in my head.

JACK—Well, you have to have something up there. —*Victor Lamping.*

TRY IT SOMETIME

WIFE—So you did have your hair cut?

HUSBAND—No, dear, I just had my ears moved down a half an inch.

—*La Verne Anderson.*

WOE IS ME, WHOA!

PASSENGER (after the first night on board ship) — What's become of all my clothes?

STEWARD — Where did you put them last night?

PASSENGER—I hung them in that cupboard over there. The one with the little round glass door on it.

STEWARD—That isn't the cupboard. That's the port-hole.

—*Frank Lindenfelser.*

AND SUCCEEDED

FIRST WORM—How did your wife get to acting so crazy?

SECOND DITTO—Oh, she tried to have the last word with an echo!

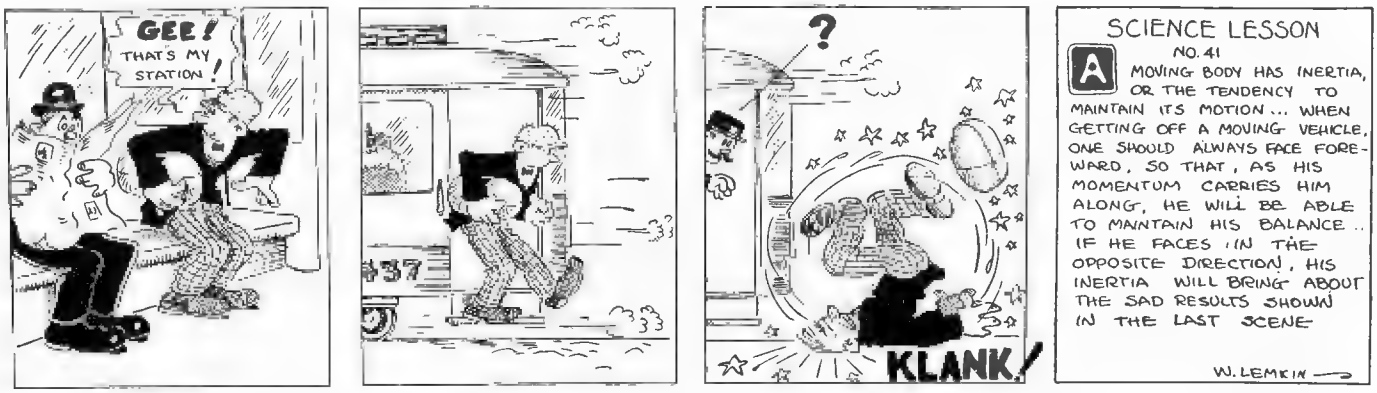
—*Warren Rose.*

DID HE EXPECT ICE CREAM?

The little boy from the slums was being shown around the dairy farm. He watched the process of milking with interest, but after tasting a glass of the fresh milk he said, "You'll have to let it run for a while. This is warm."

—*H. Freeman.*

Scienty Simon—*Scientist*


GEE! THAT'S MY STATION!
?
KLANK!
SCIENCE LESSON
NO. 41
A MOVING BODY HAS INERTIA, OR THE TENDENCY TO MAINTAIN ITS MOTION ... WHEN GETTING OFF A MOVING VEHICLE, ONE SHOULD ALWAYS FACE FORE-WARD, SO THAT, AS HIS MOMENTUM CARRIES HIM ALONG, HE WILL BE ABLE TO MAINTAIN HIS BALANCE .. IF HE FACES IN THE OPPOSITE DIRECTION, HIS INERTIA WILL BRING ABOUT THE SAD RESULTS SHOWN IN THE LAST SCENE
W. LEMKIN

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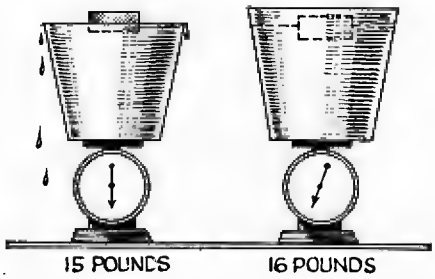
Ask Archimedes

(2348) Robert Johnson, Philadelphia, Pa., writes:

Q. 1. Reading an issue of your magazine, and seeing that you have a department devoted to questions and answers, I would like to ask the following question. If a pail containing water weighs 15 pounds, and an object weighing one pound is placed in the water, does the



This is not an intricate problem, but it is probably as interesting as that described in the February issue.

pail weigh 16 pounds or 15 pounds?

A. 1. The weight of the pail in this instance depends on certain conditions. One of these conditions is the amount of water in the pail. If the pail is completely filled, and the object placed in it floats, then, according to Archimedes law, this object should displace its own weight of water. The overflow would naturally lessen the entire weight of the pail, and consequently, the weight would be 15 pounds and not 16. If the object placed in the water sinks to the bottom, it will displace the liquid equivalent of its specific gravity. In this case the pail would weigh more than 15 pounds, this factor depending on the density of the object placed in the water. If the pail was not filled to the top when an object was placed in it, the entire weight would increase in accordance with the additional weight of the object.

Now It Is and Now It Isn't

(2349) Martin Gardner, Tulsa, Okla., writes:

Q. 1. I have recently read an article on handwriting and forgeries in which it is stated that ink eradicators do not remove the ink, but merely bleach it, and that ink so bleached can be easily brought out by a process of "fuming" known to all handwriting experts. Can you give me a description of this process, what chemicals are used, and how it is performed?

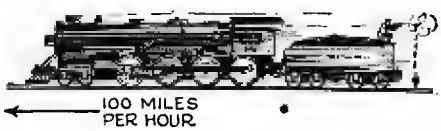
A. 1. The article was correct. Ink eradicators do not remove ink, but bleach it. Two liquids are usually used. One of them is a mild acid and the other a strong bleaching agent in the form of a hypochlorite. Sometimes the ink may be brought to something near its original state by merely heating the paper or cloth on which the ink is recorded. If the ink has an iron base it may be brought back to its original state by fuming with sulphuric acid.

The Oracle

Try This on Your Rifle

(2350) David Watkins, Kansas City, Mo., writes:

Q. 1. During one of our physics classes this question came up. A train is traveling north at the rate of 100 m.p.h.; a gun is fired from the train at the same rate in the opposite direction. What happens to the bullet? I maintain that the bullet falls to the ground from the gun. My reasons for this conclusion are as follows: the bullet while in the gun has an initial velocity of 100 m.p.h. due north. This bullet has a rate of 100 m.p.h. toward the south. When



Another problem, but it is merely theoretical. Is the speed of the bullet possible?

the gun is fired the bullet has a rate of 0 m.p.h. The gun literally goes off and leaves the bullet. Then the force of gravity goes into effect and the bullet falls to the ground. I hope to see a solution of this problem in an early issue of your magazine.

A. 1. Your solution is perfectly correct. In shooting a bullet from a rifle under ordinary conditions, there are two forces entering into its flight. One is the force of gravity, downward, and the other is the velocity imparted to it in a horizontal direction by the rifle. In this case, the velocity of the train is 100 miles an hour in one direction, and the velocity of the bullet is 100 miles an hour in the opposite direction, consequently these two forces neutralize each other. The only force, therefore, that enters into the flight of the bullet is gravity. This would cause the bullet to drop almost immediately to the ground. As the object drops with a speed of 32 feet per second, it would seem to the human eye that the bullet hit the ground almost immediately.

The Oracle is devoted to questions of general interest. Write legibly on one side of paper. Send diagrams or sketches on separate sheets. A nominal charge of fifty cents is requested from those who desire a quick answer by mail.

Ten Years After

(2351) H. C. Long, Tishomingo, Miss., asks:

Q. 1. There is a certain star that is so far from the earth that it takes the light from this star 10 years to reach the earth. Should this star cease to shine tonight, would the people on this earth know it ten years from tonight?

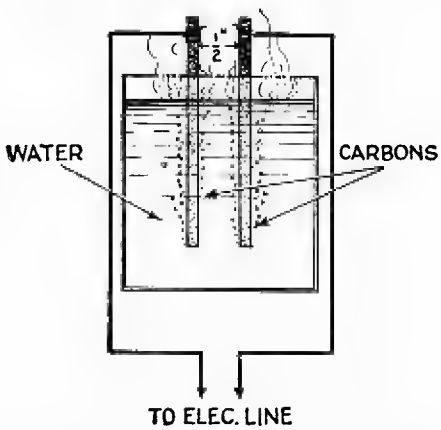
A. 1. Granted that the light ceased instantaneously, the people on the earth would have no indication until ten years after the extinction.

One Way of Getting Hot Water

(2352) James J. Atkinson, Pelham, N. Y., asks:

Q. 1. What is the most efficient form of converting water into steam by electricity?

A. 1. Tests seem to indicate that from the standpoint of efficiency, the heater employing two electrodes immersed in a liquid gives the most economical results. These electrodes can be made of carbon, or any metal that will not be attacked by electrolytic action. The heater is non-operable if the water used is distilled or if rain water is employed. A slight quantity of some impurity is necessary. This impurity need not be replenished, because it does not pass off in the form of steam or gas. One obvious advantage of a heater of this type is that as soon as the water boils off, the current is automatically interrupted. By



We know of no simpler method of obtaining hot water than is shown above.

properly proportioning the plates in respect to size, and with reference to their distance from each other, it is possible to connect the heater directly to the 110 volt power lines supplying either alternating or direct current. Aluminum electrodes ¾ of an inch wide separated ½ inch, and 10 inches long will not pass too much current so as to blow fuses. A small quantity of salt will render the water conductive, if rain water is used.

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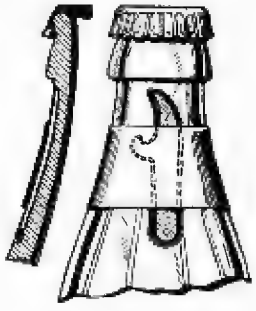
Yankee Brains *at* Work

Sniffing Simplified

No. 1,732,674, *issued to Roger J. Dever. The inventor's object was to provide a device which might be used as a deodorizer or humidifier. It comprises an electric heating element for vaporizing the liquid on a wick and a means of preventing the liquid from flowing into the base.*

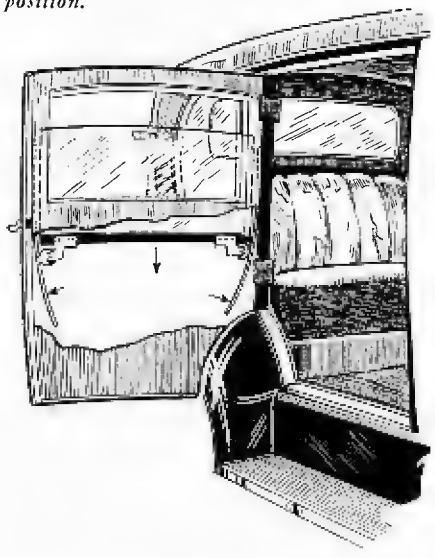
An Aid for the Soda-Pop Addict



No. 1,725,726, *issued to Lucy Cotton Ament. The object is to provide a means for equipping soda bottles or the like with a metal opener. It comprises a bottle built with a recess and a metal opener to fit into the recess and be secured by paper tape.*

Non-Backfiring Window

No. 1,741,525, *issued to Ernst Kreissig. Provides a spring-counterbalancing means of preventing a window from sliding up due to faulty sash-weights. It consists of two members reinforced by springs which press against a slidable member, rendering it immovable when placed in a certain position.*



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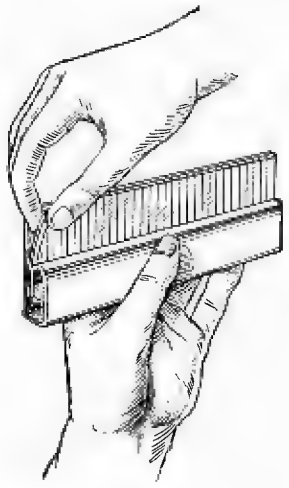
Recipe Rack for Young Cooks

No. 1,729,126, *issued to George H. Reimer. The invention relates to card index boxes for holding recipes. It consists of a rectangular box for containing individually removable cards, and external projecting members to secure these cards in an upright position at the edge of the box.*

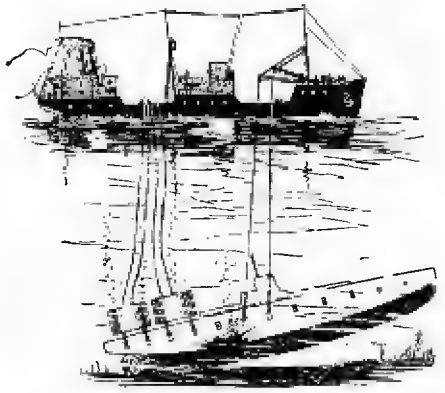
A New Coat for Lucifer



No. 1,739,822, *issued to Egar Bouchard. The inventor's object was to improve the construction of paper match books, and so arrange them as to cause the match to light when withdrawn from the book. It consists of a rectangular piece of material divided into a number of matches, a protruding edge of abrasive material folded over the tips of the matches and so arranged that it will ignite the matches when they are withdrawn—one at a time.*

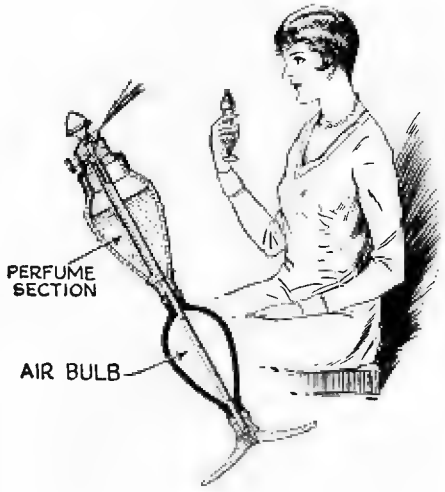
Save Our Subs

No. 1,740,231, *issued to Edward Ellsberg. The invention relates to the rapid salvaging of sunken submarines. It consists of a means for equipping the boats with hooks, built into the hull while construction is proceeding, and in addition outlines the correct means for obtaining the maximum strength from these hooks. It also provides for pontoons which may be used to raise the sunken boat from its position.*



For the Ladies

No. 1,740,373, *issued to Arthur J. Shaukis. The invention seeks to improve atomizers so that they will be non-leaking and air-tight, and in addition be more compact and efficient. It comprises two compartments, one for air and one for liquid, a base from which leads an air tube topped at the exit by a nozzle.*



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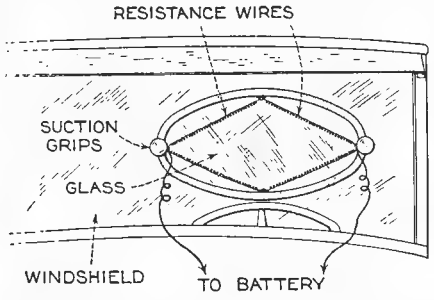
Should advice be desired by mail, a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

Clear Windshields

(1210) W. R. Johnson, Lincoln, Neb., suggests a means of heating the glass of a windshield by means of an electrical heating element operating on a car's electrical system and placed near the edges of the glass for the purpose of preventing the accumulation of moisture and for melting snow and sleet formation.

A. 1. This suggestion is not new, and is poorer than a great many of the systems



already devised. One of the simplest consists of a large rubber gasket in which is set an oval-shaped piece of glass. The gasket is fitted with a diamond-shaped resistance coil substantially as indicated in the diagram. The gasket is held in place by the usual rubber suction devices. This idea is far superior to yours. The heat is not in direct contact with the glass, and is evenly distributed over the important visual part. In your method heat is applied to the edges of the glass, and as glass is a relatively poor conductor, there is a greater likelihood of breakage should the glass be wet by a cold drop of water after current to the resistance wire has been turned on for some time. The mid portion of the glass through which the operator must look is the coldest part and more likely to accumulate moisture and sleet. We suggest no action.

Can He Patent?

(1211) F. H. Reynolds, Temple, Texas, asks if he can take out a patent on an electrical apparatus already patented, but a decided improvement on the original. He wants to know how he can go about it, how much it will cost and if it would be necessary to have a model made.

A. 1. Your letter does not contain sufficient information to warrant a definite answer. You state that your idea is an improvement of the original, but do not advise if it is a radical departure of the same.

If it is merely an improvement on an existing machine you can get a patent on the improvement, provided, of course, that the improvement has not been heretofore covered. If you then build the new machine with your improvement you will have to pay royalty to the present holder of the patent should he agree to sell such an interest to you. If he refuses, you can do nothing but offer your improvement to him. If the holder of the patent does not take your improvement under consideration, there is nothing that you can do with the idea.

Our suggested procedure would be to place the entire matter in the hands of a reliable patent attorney; let him make a search and advise you on costs. Charges will depend largely on the amount of work the attorney must do, the number of drawings that have to be made, possibility of interference, etc.

Most patents are taken out with drawings as a foundation. In the majority of cases, even the experimental model is not constructed. On occasion, the patent office calls for a model, whereupon you would have to build the same. This is rare.

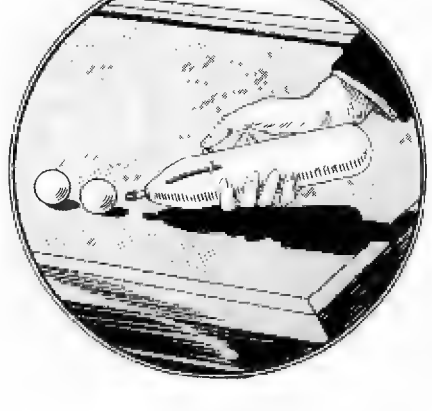
Two Games

(1212) Wallace Nordwall, Duluth, Minn., asks for our opinion on two games; one of which is a ball shooter for small pool and billiard tables, and the other is a horseshoe pitching game, with small shoes and spring actuated pitching devices.

A. 1. Neither of the ideas which you have advanced is strictly new. The billiard shooter is a relatively old stunt and has been devised for use on small $1.00 pool tables. While the hand instrument is slightly different than those now employed, its effect is practically identical. In the modern styles two hands are used, one hand guiding the cue and the other pulling back on the cue and releasing it, whereupon a spring drives the cue forward and it hits the small billiard ball. This type is more nearly like the original game than your single-handed shooter and hence better than yours.

The table horseshoe game is not very practical because it reduces the necessary

(*Continued on page* 1124)



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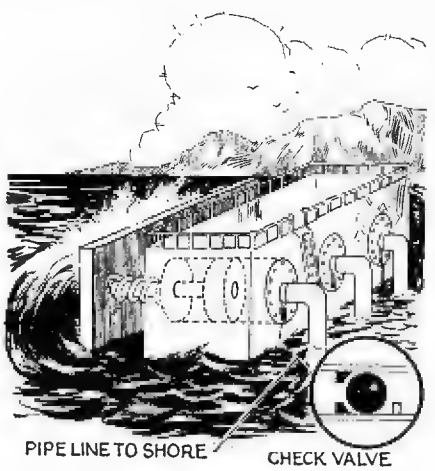
skill and is another of the many shooting products now found on the market. If an individual is desirious of pitching horseshoes, he can find the rubber horseshoes quite effective, non-destructible, and non-damaging. We doubt very much that a market for either product can be obtained, even if you manufactured the same yourself and would not advise patent procedure.

Wave Motor

(1213) W. B. Jaruis, Marshfield, Ore., submits an idea for a wave motor consisting of a large concrete structure provided with a plate which communicates with piston-like devices moving back and forth in cylinders. Waves dashing against the plate drive it back and operate the pumps. The compressed air so produced is to be employed for developing power.

A. 1. Hundreds of systems for developing power by the force of ocean waves or by the undulating movement of those waves have been devised, patented, and some have even been experimentally tried.



The difficulty with all methods of this nature is that the inventors do not take into consideration the terrific pounding produced by the waves, the variability of the source of power, the damage that can be done to the various parts of the apparatus by débris, tree stumps, flotsam, and the damage that can be done by large cakes of ice, freezing temperatures and the like.

While waves always do present a source of power it is quite impossible to build a structure that will constantly withstand the terrific bombardment upon the surface.

One of the simplest of methods that uses the power of ocean waves as a source of compressed air supply, consists of an ordinary steel tank submerged a considerable distance from shore. The bottom of the tank is open. As the waves rise and fall, a greater or lesser quantity of air is compressed in the steel tanks and a pulsating form of energy is set up. This alternating compression and decompression of the air can be used for actuating engines which in turn produce power. Inasmuch as almost the entire steel tank is under water at all times, the method presents a rather safe way of utilizing power from ocean waves, but even here a good anchor is costly.

There are very few organizations that would be interested in exploiting a product of this nature, and as a consequence, we would advise against patenting procedure.

Tesla Maps Our Electrical Future

By H. Winfield Secor

(*Continued from page* 1077)

quite extensively," said Dr. Tesla, "but I had similar filamentless, gas-filled electric lamps in my laboratory at Houston Street over thirty years ago. I even had these lamps standardized to 50 candle-power each, and used them instead of the orthodox illuminating devices. It seems that I was also far ahead of my time in the use of filamentless tubes, bent in the shapes of characters and other forms, as now extensively used. The light from properly filled vacuum tubes is of indescribable beauty, hygienic and more economical, and the lamps last forever. For these reasons, I predict that very shortly the old-fashioned incandescent lamp, having a filament heated to brightness by the passage of electric current through it, will entirely disappear and that we will shortly be using new filamentless, gas-filled lamps in our homes, offices and factories throughout the world."

I asked Dr. Tesla what he thought of the eventual development and form of television apparatus.

"The present day television inventors are on the wrong track," said Dr. Telsa, "and we shall see in a future not distant, a very simple means of transmitting the living daylight image over a wire or by wireless, without the use of any scanning disc, special synchronizing means and all the bewildering paraphernalia now employed to give an image the size of a postage stamp, and one that is far from satisfactory at that. I have made discoveries many years ago which give me every reason to believe that television of the future will have all of the complicated parts located at the transmitting or central station, and all that the subscriber will have in his home or office to receive the reproduced image will be practically nothing but a screen, together with a suitable wave or station selector."

Among some of the interesting and revolutionary inventions perfected by Nikola Tesla, and which are little known to the public, we find such radically new apparatus as that for the wireless transmission of power, bladeless turbines, airplanes that rise and descend vertically, Tesla high frequency transformers, and the Tesla viscosity speedometer. The higher-priced American cars are fitted with the Tesla speedometer, which registers the speed in miles per hour; and also for the engineer's use there is the tachometer, or revolution counter, using the unique principle applied by Tesla, viz., the viscosity or drag of the air between two discs or cups. One of the accompanying diagrams shows the principle of this extremely simple and accurate speed indicator.

I asked Dr. Tesla if his speedometer was to be used on some of the American cars being built in very large numbers, and he stated that he had received inquiries from Ford and other quantity producers of automobiles, and as soon as the manufacturing price could be made to conform with the low cost necessary for the cheaper-priced cars, they undoubtedly would be fitted on these cars. This speedometer is based on the fact that when one disc is driven by a flexible shaft from the engine transmission, the drag of the air particles between this revolving disc and a closely positioned second disc is such that the latter will be turned through part of a circle, proportional to the speed of the driven disc. It is only necessary, therefore, to calibrate the second disc in revolutions per minute or miles per hour,

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to have a perfect speed indicator.

In the Tesla steam turbine no blades of the usual type found in such machines are employed at all. Instead there is simply a series of smooth discs similar to a number of phonograph records, mounted on a shaft with a small space between them. When gas, steam or water, for example, is allowed to strike through or between these discs from the nozzle, the friction of the fluid on the surfaces of the discs causes a rotation of the same and their attached shaft. As much as twenty horse-power per pound of weight of rotor can be developed by his turbine. Dr. Telsa took out patent in every important country in the world on this unique type of prime mover and it represents the very simplest form of apparatus for converting energy yet discovered.

Aircraft of today are far away from the ultimate form, thinks Dr. Telsa, and the airplane of tomorrow will, he believes, be driven by wireless electric power transmitted from the central station or stations located at various spots on the earth. In this respect it is interesting to mention that Telsa has shown, thirty years ago in patents and in textbooks, the complete system for transmitting and receiving wireless power, with all the tuning circuits, transformers and other details.

Tesla upholds the startling theory formulated by him long ago, that the radio transmitters as now used, do not emit Hertz waves, as commonly believed, but waves of sound. He says that a Hertz wave would only be possible in a solid ether, but he has demonstrated already in 1897 that the ether is a gas, which can only transmit waves of sound; that is such as are propagated by alternate compressions and rarefactions of the medium in which transverse waves are absolutely impossible. Dr. Hertz, in his celebrated experiments, mistook sound waves for transverse waves and this illusion has been continually kept up by his followers, and has greatly retarded the development of the wireless art. As soon as the experts become convinced of this fact they will find a natural and simple explanation of all the puzzling phenomena of the so-called radio.

Sees Wireless Power Transmission

Dr. Tesla bases his vast amount of work on the wireless transmission and reception on the marvelous phenomenon of terrestrial resonance, which he discovered in 1899, and his "magnifying transmitter." He considers the whole earth as a huge wire or conductor, and having determined its constants in electrical units, he has designed the proper wireless transmitter needed to set the globe into powerful electrical vibrations, so that at any point of its surface. If we desire to operate lights or motors according to Telsa's power transmission theory, all we have to do is to connect an electrical capacity, such as an antenna or other suitable system of conductors through the apparatus. This capacity then absorbs its proper quota of oscillating electrical energy of the transmitter. We have today only radio signals or radiophone speech, but if Tesla's theory is right, and many engineers think that it is, eventually we shall have no more power transmission lines running from central stations for hundreds of miles to supply us current for our electric fans, toasters, stoves and lights. We shall instead have an electrical capacity in the form of a ball or cylinder perhaps, placed in our attic or possibly in the ceiling of the house and when connected through a Tesla transformer to the earth, we will pick up the desired electrical energy to operate our

(*Continued on page* 1126)

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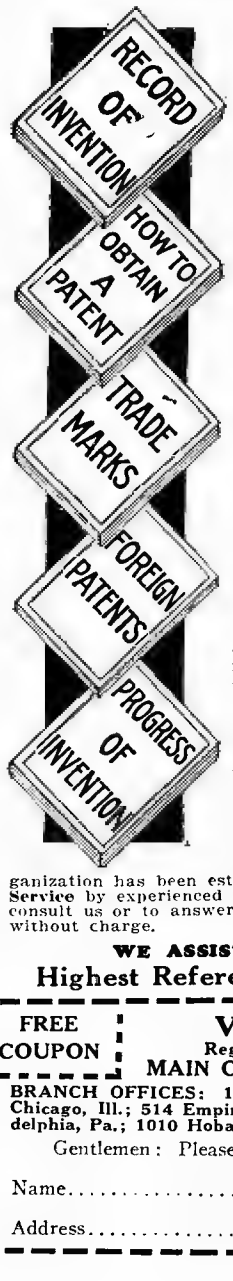

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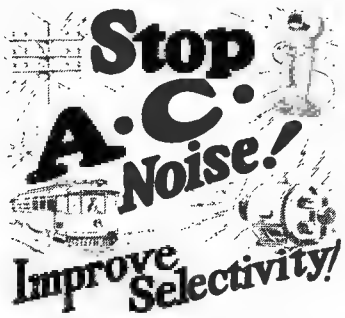

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Tesla Maps Our Electrical Future

(*Continued from page* 1125)

household devices. It will be a simple matter to connect a meter with this arrangement, so that the energy can be measured and paid for in the regular way to the central station owners.

Flying around the world with a Tesla powered airplane is a possibility of the near future. The plane will not have to store every bit of available space with gasoline and oil, nor will it have to carry a heavy engine or engines. A light electric motor will spin the propellers, if indeed we use propellers at all for tomorrow's aircraft; the necessary high frequency electrical energy for operating the motor will be accumulated by a suitable electrical capacity or antenna carried by the plane or other form of aircraft, whatever it may be. A recent patent granted to Dr. Tesla describes one method of causing a plane to rise and descend in a vertical line. As soon as we have a plane which can accurately and regularly rise and descend vertically, the day of the aerial taxi will be here, for we can then land or take off from any flat building roof in our great cities, no matter how small the roof may be. Dr. Tesla says that his flying machine can be condensed into a cube of less than 6 feet on a side, and its weight will be less than 250 pounds. It can be run through the streets and put in a garage, if desired, just like an automobile.

Tesla's Artificial Lightning

One of the most interesting experiments in all electrical phenomena which has intrigued the writer for many years is the production of gigantic electrical discharges. We read every now and then about high voltage discharges in the neighborhood of a million volts or so, produced in the great laboratories of the large electrical manufacturing companies for testing insulators and the like; but no one up to the present time has even approximated the gigantic artificial lightning displays produced by Nikola Tesla in his famous Colorado wireless broadcasting plant forty years ago. Electrical experimenters who have studied Tesla's researches and seen some of the photographs of his stupendous electric discharges will remember that some of these measured 100 feet in length, the size of a man's arms, producing a roar comparable to that of Niagara, and which could be heard 12 miles away. College and electrical students in general, today, often build Tesla coils, which produce high frequency electric sparks of anywhere from one to three and sometimes 4 feet in length. A moment's reflection on the huge electrical discharges produced in the famous Tesla Colorado plant (in which he used 1500 kilowatts) just mentioned, will show the magnificent piece of engineering which was accomplished by him, when most of the present-day engineers were in their swaddling clothes. In those days Tesla built high frequency transformers over 50 feet in diameter, and in the production of some of his world-startling electrical phenomena he utilized the whole electrical output from a central station, involving the instantaneous discharge of millions of volts and thousands of amperes.

Tesla's theories are generally radically opposed to those entertained by the majority of scientists on many subjects, absorbing the interest of the public. He denies the existence of an electron as pictured by science and says that it has never been isolated. He thinks that some of the investigators have mistaken a hydrogen molecule for an electron, a rather comical error when considering that the former is assumed to be 125,000,000,000,000 times bigger. He deprecates the popular idea of deriving motive power from the disintegration of atoms, or change of elements, and characterizes such schemes as worse than those involved in perpetual motion machines. He holds that radio-activity is due, not to forces in the substances themselves, but to a cosmic ray, the discovery of which he announced in 1897. In other words, an element like radium emits radiations merely because the cosmic ray impinges upon it, producing these secondary effects.

The element itself has no such energy, it all comes from the cosmic ray. Tesla says that he has proved the existence of this ray by mathematical analysis and experiment, finding both in perfect agreement. It would seem to follow, from Tesla's theory, that the radiation from radiums, or similar bodies, would change from place to place on the globe; and this has recently proved to be an actual fact, as determined by a Russian investigator.

Tesla assured the writer in a recent interview, that through a new discovery he has perfected rays of tremendous power, penetrating through miles of solid substances, will become available shortly, by the use of his high potential cathode tube, without a target.

Truly it may be said that Nikola Tesla was 100 years ahead of his time, and there is not the slightest doubt that his name will go down to posterity as one of the greatest inventors and electrical discoverers of all time. Hundreds of patents cover Telsa's inventions,* and many thousands of his transcending ideas in the fields of mechanical and electrical invention have never been patented at all, but his ideas are recorded in his own private files.

*See Tesla's Patent Numbers, and also Sewall's "Wireless Telegraphy." Also "Experiments With Currents of High Potential and High Frequency," by Nickola Tesla, 1890 and "Problem of Increasing Human Energy," Century Magazine of June, 1900.

Inexpensive New Lathe

THIS very interesting and inexpensive lathe embodies features not found in any tool of its type. The bed of this lathe is channel steel with a support in the center of the bed to give added rigidity and stability. The bed is 30 inches long and will take wood-turnings 6½ inches in diameter and 28 inches long, but if it is desirable to turn longer pieces, another bed can be added. The entire lath can be obtained piece-meal, so to speak, for the individual parts are separately sold. Both head and tail stocks are movable along the bed and clamp down solidly. The tool rest is very sturdy and adjustible three ways, and a gall thrust bearing on the head stock carries the end thrust. Its best operating speed is 1750 r.p.m.

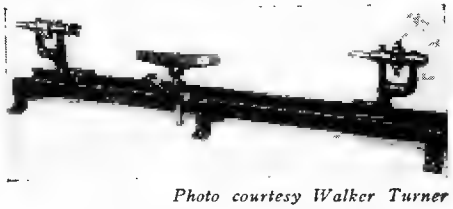

Photo courtesy Walker Turner

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Brains of Silver Eyes of Glass

(*Continued from page* 1084)

product is added to a mixture of gelatin, potassium bromide, and potassium iodide, heated to a proper temperature. The precipitate of silver salt is held in suspension by the gelatin, thus forming a true emulsion.

The emulsifying process is carried on in steam-jacketed vessels, lined with silver and equipped with agitators. Soluble salts formed must be washed carefully away. The emulsion is chilled into jelly, shredded, and cleansed with cold water, after which it is melted and coated on the basic film.

This completes the manufacturing process proper. There remains only the setting or hardening, which takes place in chilled rooms.

Optical glass for camera lenses arrives from the manufacturer in slabs. Faults are marked and are eliminated by grinding. Following this, the slabs are ground on all surfaces to remove bits of clay left from the molding process. Next they are sawed into strips on milling machines equipped with diamond-impregnated saw discs, and the strips in turn are sawed into cubes of standard sizes.

The cubes are softened in a gas furnace and pressed into discs on a pneumatic press. In an electric oven the discs are heated gradually to a temperature of about 1000 degrees. to relieve strains incurred in the pressing process, and cooled at a rate no less gradual, so that no new strains may occur.

Cooling completed, the discs are examined for strains under a polariscope, and if found satisfactory are inspected for pressing defects in a liquid whose refractive index approximately equals their own.

Grinding-shells, conforming in shape to the character of the surface wanted, are used with emery powder to fit the discs for their photographic function. Gradually the discs become lenses, conforming exactly to the shape of the grinding-shells. Lenses which are small or which have a very flat contour are ground several at a time, affixed to a metal blocking tool coated with pitch. Much of the finer work on anastigmat lenses must be done by hand.

In polishing, rouge takes the place of emery, and grinding-shells are lined with felt or wax. Wax-lined shells are used for the finer lenses. Considerable experience is needed for the precise adjustment of a polishing machine, since the curves of both sides of the lens must be exactly the same. A difference of even 1/30,000 of an inch will show itself in circles of color or rings.

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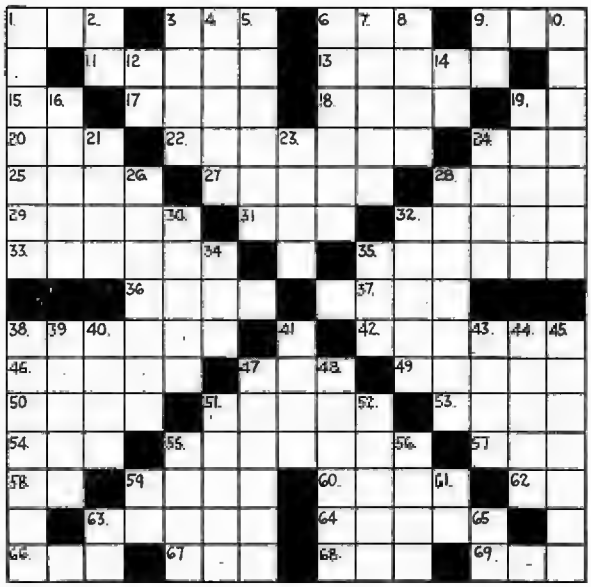
ACROSS

1. Popular nickname of two towns, one in Canada, one in Michigan; of a canal; of a falls; a river, and a railroad, all between Lakes Superior and Huron.
3. River in Persia flowing to the Persian Gulf.
6. A plan or representation of the geographical features of the earth, or of some portion of it.
9. Poetic name of the country Columbus set out to find.
11. The largest province in British India.
13. Superficial dimensions of the geographical divisions of the earth.
15. An island off the west coast of France near La Rochelle.
17. A "Cove" in Allegan County, Michigan, opening into Lake Michigan.
18. Greek island of the Cyclades group in the Aegean Sea, anciently known as "Ios."
19. An ejaculation of surprise or wonder. Exclamation sign after it.
20. Contraction of "I have."
22. City in New Haven County, Connecticut, noted for the manufacture of Britannia ware.
24. Wine, in French.
25. Greek word for thread; a combining form used as a prefix in English words.
27. Russian naval station of the Baltic Sea.
28. Abominable; also the name of a brother of Odin of Norse myth.
29. A gridiron; also, to broil.
31. Copper or bronze coin current in Japan.
32. An Indian tribe of Arizona. There are two towns in that state named after this tribe, the towns taking the singular form of the word.
33. A narrow passage of water connecting two larger bodies of water.
35. A "Point" on the Thames River near New London, Conn., a landing place for boats.
36. A mountain in Dauphin County, Penna.; a "resort" mountain in Orange County, N. Y., on the Hudson River; a river in Idaho and Utah—all named after an animal of the genus *Ursus*.
37. A river in South Africa tributary of the Orange River.
38. Large lake in Maine, the habitat of a certain variety of salmon known by the name of the lake.
42. An island in New York City.
46. A province in Abyssinia.
47. A wager.
49. Town in Catania province, Sicily.
50. Town in Macon County, Missouri.
51. Man's thinking apparatus.
53. The place in Greece where the original Olympic Games were played.
54. The reputed ancestor of man.
55. The "Cracker State."
57. The capital of Ladakh, British India, in the valley of the Indus near the Himalayas. An important trading center.
58. Abbreviation of "mountain."
59. An island in the Aegean Sea off Asia Minor; also a town on the mainland of the same name.
60. A river in Italy; also a city in Nevada.
62. An Egyptian solar deity.
63. A Seraglio.
64. Images and sacred pictures venerated by Greek Catholics.
66. That great body of salt water which covers a large portion of the earth's surface.
67. An affected way some girls named "May" have of spelling the name.
68. Abbreviation of the name of the highest branch of the Congress.
69. The goddess of dawn.

DOWN

1. Fountains of water coming from the ground, after which many resort and other places have been named, as "Saratoga," "Hot," etc.
2. Large river in Siberia.
3. Capital of Meath County, Ireland, which contains the ruins of a castle built by King Henry II.
4. A Mohammedan noble or prince. One of several ways of spelling it.
5. A town in Worcester County, Mass., and a city in Washington County, Vermont, the plural form of the name.
6. Town on the Missouri River in North Dakota named after an Indian tribe.
7. Town in Wayne County, Penna., also, a "spirit of Air," in Shakespeare's "Tempest."
8. A common laborer, in the country of our neighbor on the south.
9. An ancient city near Babylon on the Euphrates River noted for its asphalt.
10. A characteristic of desert lands, but not yet of the U. S.
12. Above.
14. To wit.
16. To turn inside-out.
19. Cathedral city in Italy.
21. A Mohammedan prince; one of several ways of spelling it.
23. Distinguishing part of name of a town in England famous in nursery rhyme; a town in Middlesex County, Ontario; a town in Muscatine County, Iowa; a "grove" in Racine County, Wisconsin—all named after the patron saint of lawyers.
24. A World-War famous "ridge" in France.
26. The "Cotton State."
28. A small town.



30. City in Belgium where the Germans were halted in August, 1914.
32. An island off the coast of Ecuador, in the Pacific Ocean; a city in Argentina, South America, and a "Rio" between Uruguay and Argentina (article omitted).
34. A town in Hoo-Nan province, China; also the first part of many names of places in that country; also, an "ism" of China.
35. A ridge of sand and gravel formed in one of the geological eras, from Dane-Norwegian language.
38. An island off the coast of Attica, Greece, where Themistocles defeated the Persians under Xerxes in a naval battle in 480 B.C., one of the most notable battles in history.
39. The land of the Pharaohs.
40. The French way of spelling "Baden," in Germany.
41. A Cape on the North Carolina coast.
43. A river in Northumberland, England.
44. An Indian tribe; after which a Great Lake, a city in Pennsylvania, and a canal in New York State have been named, the places taking the singular form of the word.
45. A county seat of Hillsborough, New Hampshire at the junction of the Merrimac River and a river of the same name as the city, both being named after an Indian tribe.
47. One of the so-called "Southern tier" of counties of New York state.
48. A river in Mesopotamia on which is Bagdad.
51. Village in Cuyahoga County, Ohio; the seat of a Methodist Episcopal university.
52. A close female relative.
55. Abbreviation of the name of a country with which we were at war in 1918.
56. Soon.
59. Abbreviation of the name of the "Creole State."
61. A city of ancient Egypt sometimes known as Heliopolis (Genesis 41-45).
63. Abbreviation of "Hawaii."
65. Symbol for a direction half way between south and east.

Solution on page 1149

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Once He Made Steam Automobiles—Now Violins

By William T. Miller

(*Continued from page* 1089)

of his brother in 1918, Freelan Stanley withdrew from active control of his automobile concern and devoted more time to his numerous other business interests and to academic work. At the present time he is chairman of the Trustees of Hebron Academy in Hebron, Maine, and spends several days there each week during the school season supervising the affairs of the institution, making the trip of several hundred miles "down east" from Boston, regardless of the weather.

But what happened to Freelan Stanley's hobby during these years of business conquest? Despite his business and teaching activities he has persisted in his love for violin making. And he is still his happiest when one of his lovely instruments is taking form in his hands.

Not more than a mile or so from the place where the Stanleys started in the automobile business, Freelan Stanley has built a beautiful brick colonial mansion, surrounded by shaded lawns, and gravel drives. In keeping with the house is a large garage, and adjacent is a modern workshop where Mr. Stanley and his nephew Carlton make violins. There is no production line here, and no time-schedule for work.

Through the years Mr. Stanley has made a study of his hobby. He has visited European cities famous for their violins, and obtained first hand knowledge of how the masters worked. In Cremona, Italy, where Stradivarius and Amati plied their trade long years ago, he obtained pieces of rare spruce wood, and from Germany he obtained slabs of maple. Incidentally, Mr. Stanley points out that some of the best wood for violins may be found in old furniture which has seasoned through the centuries.

The first Stanley violin was made with a jack knife, but the studio where Mr. Stanley works today is equipped with the best tools that money can buy, and he has developed special processes which require jigs of his own invention. Back of his love for his hobby, Mr. Stanley admits, is not only the appreciation of good music, but the desire to make an instrument capable of enduring and of producing faultless tones.

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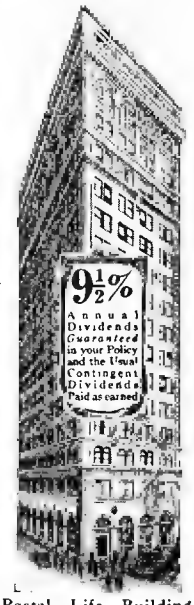

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America's New Motors Pass In Review

By Murray Godwin

(*Continued from page* 1085)

Strain on cylinder block and crankcase is decreased; the usual solid casting of the latter is replaced by a frame with removable plates, rendering rods and levers completely accessable. The small size of the cylinders in proportion to power rating makes streamlining easy and effective, and there is less heat to be carried away. Adapted to airplane use, an aircooled engine operating on the lever principle is said to have carried a plane fifteen miles an hour faster than the same ship could travel behind a radial job of equal power rating.

The Elcar lever motor develops peak power at a low speed, and a car equipped with one is claimed to handle in city traffic at 100 r.p.m. A faster rear axle therefore can be used, with a consequent lessening of motor wear. Less vibration, easier shifting, and smoother riding are among the other advantages claimed for this very interesting automotive powerplant, and also a remarkable saving in gasoline and oil.

Insulation—A Paying Investment

By S. Gordon Taylor

(*Continued from page* 1087)

itself or in the attic floor, depending on whether the attic is to be used for livable purposes. If it is not so used, insulation may be placed between or on top of the joists of the floor. If the attic of an existing home is floored, a few of the floor boards may be removed and loose insulation dumped into the space between joists. If the attic is finished and is heated, the insulation should, of course, go into the roof, and the method of insulation will depend on the conditions.

Even where the owner does not care to go to the expense of insulating the whole house, he would do well to insulate the roof or attic floor thoroughly, because authorities estimate that over half of the heat losses through exterior surfaces of a house take place at the roof. In an existing house the owner can do this job himself without difficulty. The insulation of the side walls of an existing house is scarcely a job to be undertaken by the owner because special equipment is required for blowing it in. There are insulation contractors in most localities who are equipped to do this work.

In selecting insulating material the home owner or home planner is offered a wide choice in which he will be aided materially by the Bureau of Standards' circular mentioned above and by literature distributed by manufacturers, a list of which appears on page 1147 of this issue. Many of these booklets provide a most comprehensive treatment of the whole subject of insulation, providing all the information necessary to enable the home owner to not only select the insulating material best suited to his requirements, but also to determine in advance the saving in fuel which will result.

For an existing house where it is necessary to deposit the insulation in the hollows of the walls with blowers, the choice of materials is limited to those marketed in

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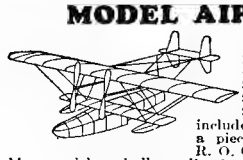

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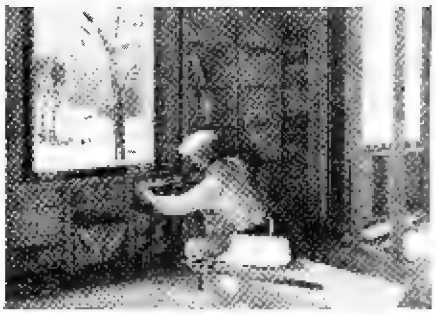
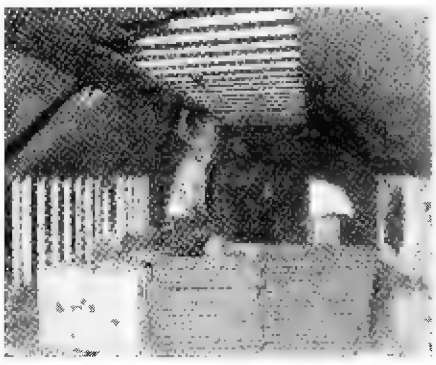
loose form. But in new construction there is a wide range of selection. There are the soft flexible blankets filled with fibrous or other materials; the rigid or semi-rigid boards and sheets; the loose materials; and one which is blown onto the inner wall structure in the form of a pulp which hardens to provide a complete insulating coating between studs.

In applying insulation one effective method is to so locate it that there is an



Fireproof insulating material in block-shaped packages fits snugly between the studs. Excellent insulation at low cost. (Johns-Manville.)

air space on either side, thus taking advantage of the insulating qualities of the material itself plus those of the two dead air spaces. If the space between sheathing and lath is 4 inches, insulation nailed to the studs, midway between sheathing and lath, will divide the large air space into two smaller ones, each of which has an insulating value approximately equal to that of the original space. This type of installation adds about 50% to the insulating value of the material itself. The flexible blanket type of insulation lends itself most readily to this treatment. Loose materials require little labor to install and most of them have extremely high insulating value because of the usual method of application they completely fill the spaces between studs to form what amounts to a four inch thickness of insulation, as compared to the usual thick-



Corkboard lining will keep this attic cool in summer and easy to warm in winter. (Armstrong Cork Company.)

ness of one inch or less for most blanket or board types. Some of these loose materials come in paper packages of just the right size to fit between studding without removing from the packages.

Stiff or board type insulation may be installed across the face of the studs, in place of lath, and the plaster applied directly over it. Or it may be employed in place of wood sheathing. Some types are not as good plaster bases as wood or metal lath but all provide added insulation and the cost is partly offset by the elimination

(*Continued on page* 1132)

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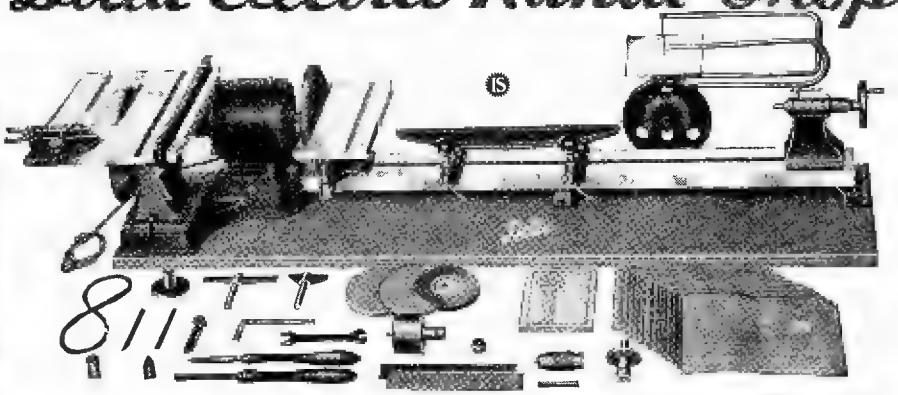

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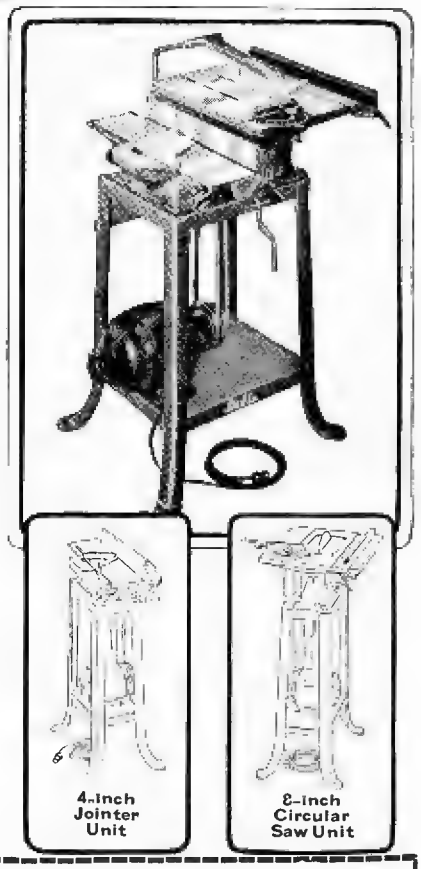

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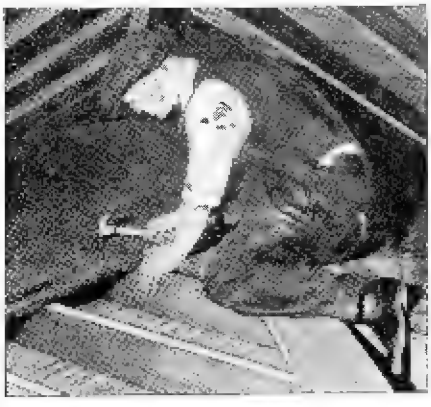
Insulation—A Paying Investment

(*Continued from page* 1131)

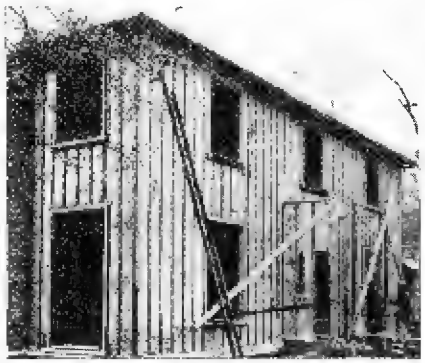
of the lath. Used in place of wood for sheathing this material provides superior insulation without increasing the cost.

In actually selecting insulation to be installed in a house, consideration should be given to (1) cost of material installed; (2) degree of insulation provided; (3) economy which will result.



Over this semi-flexible insulation a board floor, preferably on furring strips, may be laid. (Flax-Li-Num Insulating Company.)

There are other factors that are also important in selecting insulation material. Fire-retarding characteristics are a decided advantage, for instance. Also material may well be of a type that will repel vermin and rodents. Loose material should be of such nature that it will not pack or settle, leaving the upper walls without insulation. The thickness of insulation is not necessarily a gauge of its insulating quality. One insulator a half inch thick may be of greater value than another twice as thick. Also, doubling the thickness does not necessarily double the insulating value of a given make, therefore the thinner



Stucco conducts heat readily, but insulating material between it and the wood sheathing overcomes this disadvantage. (Samuel Cabot, Inc.)

form may be more economical to use even if its insulating value is somewhat less.

The cost of both labor and material for thoroughly insulating a new home adds from 2% to 5% to the total building cost. The saving resulting from the smaller heating plant requirements will frequently go far toward balancing this cost. Adding the saving in fuel, the insulation will pay for itself within five years in almost every case. Thereafter it will pay dividends indefinitely in the form of fuel saving, and of equal importance in greater comfort.

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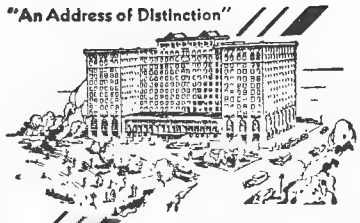

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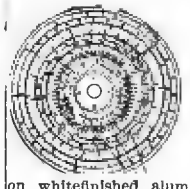

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Super-Motorways for the Motor Age

By J. Lee Barrett

(*Continued from page* 1079)

As a result of these well developed streets and highways, the automobile is used probably more than if poorer facilities were available. This has caused another problem in the form of traffic accidents. With more than 400,000 motor vehicles registered in Wayne County in addition to the thousands of tourists visiting Detroit, the city's traffic deaths have mounted to an appalling figure.

Appointment of a special committee empowered to use "every known resource of advertising, education and law enforcement," to cut Detroit's rapidly rising traffic death toll, was announced recently by Mayor John F. Lodge, at the instigation of the Detroit Automobile Club.

That the average of traffic fatalities has increased from 26 to 72 a month is due primarily to the failure of the public to co-operate with enforcement agencies, and carelessness of both drivers and pedestrians and too mild penalties in court cases.

Under the chairmanship of Fred Wardell, president of the Eureka Vacuum Cleaner Co., sub-committees have been formed to cover transportation, publicity, legislation, law enforcement, engineering and accident analysis. The transportation group will devote their activities to street car and bus lines, taxicabs and truck fleets. This committee includes members of the various utility and manufacturing companies with which the group will cooperate. Feeling that the movement is largely an educational one, a representative group of advertising and publicity men will endeavor to sell the public on the fallacy of carelessness in driving and walking on the streets of Detroit, through the medium of the press, radio, poster boards, motion pictures, window displays, and speakers who will appear before luncheon clubs and improvement associations. Under the supervision of the legislative group, a study of traffic laws in other parts of the country and their practicability as applied in this city will be made. The committee on law enforcement has agreed that another police drive is not a solution to Detroit's traffic deaths, although some of the rules, such as driving with improper lights, may be more rigidly enforced.

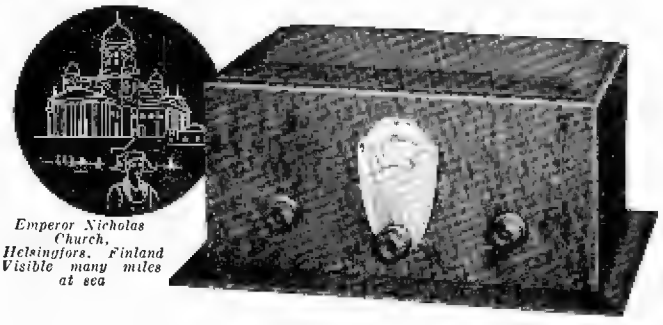
According to Clarence Wilcox, Corporation Counsel, chairman of the subcommittees, if an investigation proves that a traffic law is unreasonable and impossible to adhere to, an effort will be made to abolish it. The engineering group will investigate various recommendations as to location of safety zones, widths of streets, and other problems of an engineering nature and will supervise any changes which will make the streets safer for all concerned. An analysis of all traffic accidents and suggestions as to the proper steps to avoid future accidents of a like nature, is the duty of a sixth committee.

How to curb this carelessness and create an individual sense of responsibility, not only for personal safety but for the safety of others, is one of the problems to be solved by the new Public Safety League. Undoubtedly, if given the proper support of the people of Detroit, this new effort on the part of those most interested in our traffic problems will reduce accidents to a minimum.

Next month's traffic article will cover LosAngeles.

Hyvää päivää

(Good Day.)—Finnish



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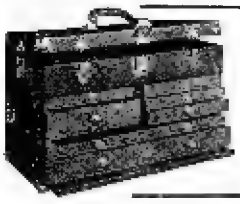

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Make a Chemical Nest of Serpents

By Dr. E. Bade

(*Continued from page* 1100)

are again added. After cooling the needles will separate out.

Another salt is Prussian blue, a precipitate obtained in the detection of nitrogenous material on decomposition of organic matter with metallic sodium. Place a small piece of metallic sodium in a small, hard test tube and heat gently to melt the sodium and so that a little vapor of sodium rises slightly above the melted metal. Then introduce a tiny fragment of substance to be tested for nitrogen and continue to heat until decomposed. Then add a few drops of alcohol to destroy any metallic sodium present and add a few drops of water. Filter and wash the test tube twice with a few drops of water. Then add a few drops of freshly prepared ferrous sulphate solution and a trace of potassium fluoride. This latter substance acts like a catalyst and promotes the precipitation of Prussian blue if nitrogen was present in the sample under test.

The alkyl isocyanides or carbamines are liquids having a lower boiling point than the cyanides and they are characterized by an intolerable odor. Their structural difference is as follows:

Methyl cyanide is CH_3CN

Methyl isocyanide is CH_3NC

Methyl isocyanide, which boils at 58 C can be prepared by distilling a mixture of potassium hydroxide in alcohol, chloroform and methyl amine. To obtain the characteristic odor, which is enough, heat a mixture consisting of ½ a gram of methyl ammonium chloride, 2 cc of alcohol in which a small piece of potassium hydroxide has been dissolved and 3 or 4 drops of chloroform. It can also be prepared by distilling a mixture of silver cyanide and methyl iodide. One slight whiff of this odoriferous product is more than sufficient.

In Amazing Stories for April

THE GREEN GIRL (a serial in 2 parts), Part II, by Jack Williamson. In the concluding chapters the author continues the pace set in the first instalment. The only intelligence we know of now is that which is housed in the human body. But is it really necessary for intelligence to have only such a habitation? Why might it not just as easily send out its influence through some other force. "The Green Girl" will, we are sure, rank high in your favor, among which we unhesitatingly mention "The Moon Pool" and "The Skylark of Space."

THE CONQUEST OF THE EARTH, by Isaac R. Nathanson. Although this story about an Andromedan invasion of the earth is by an author who is new to our readers, the story reads like an old favorite. Mr. Nathanson has not only made a careful check on his science, but he has the gift of fiction writing. And we know you will welcome the announcement that there will be more by him soon.

THE METAL HORDE, by John W. Campbell, Jr. Here is another interplanetary story by our young scientist author that is even better than his previous ones. We can leave it to Mr. Campbell to give us a unique tale, original in its conception and ingeniously worked out.

THE FEATHERED DETECTIVE, by A. Hyatt Verrill. Under this author's skilful handling this tale has an individuality that easily stands with the best scientific detective story. The green turacou and the change of color of its plumage when wet is a much debated subject among ornithologists. Mr. Verrill knows his subject. We feel no more need be said.

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When Speed Makes Time Run Slow

By Donald H. Menzel, Ph.D.

(*Continued from page* 1102)

from a few hundred up to several thousand miles a second. Of course there is nothing particularly exciting about the size of the figures. The curious thing is that practically all of the nebulae appear to be moving away from us; the farther distant they are, the faster their motion appears to be.

Why do we not find as many nebulae approaching as are receding from us? Why do they apparently shun our society? And why does the rapidity of motion increase with distance?

Let me digress a moment in a fairly close analogy. Try to imagine what might have passed through the mind of Columbus when he sat on the dock at Genoa and watched the ships sail out to sea and fade into the distance. There are two reasons, of course, why the ship grows smaller, (1) because of the increasing distance, and (2) because the ship is continually sinking below the horizon.

Now, if Columbus had believed the earth to be flat, as did most of his contemporaries, he would have had to ascribe all of the shrinkage in size to the first cause. Since the rate at which a ship sinks below the horizon increases with distance, he would have concluded that the ship was continually gathering speed as it faded from view.

This is what Columbus *might* have deduced, if he had believed in a flat earth. But the observations are much more simply accounted for on the supposition that the earth is spherical.

P.—You are probably about to say, then, that the astronomer's observations of the nebulae may be taken to indicate that the universe is curved. That the apparently greater speeds may be an illusion, a sort of "horizon effect" in the great curved universe.

R.—Right. There are several consistent solutions of Einstein's equations depending upon the amount of matter in the universe. If it were completely empty, it turns out that space and time are practically Euclidean. We are saved the trouble of trying to visualize what this means because, if it were true, we should not be here to think about it. The presence of the tiniest particle makes its presence felt at the farthest regions of space. There is a "puckering," and the universe becomes curved. The amount of curvature depends upon the amount of matter in space.

Einstein studied the problem of a world well filled with matter. In this case space is curved, but the time axis is straight. De Sitter then investigated the question of a universe wherein matter is sparsely strewn. In this case he found that space and time enter the cosmic scheme on an equal footing, i.e., that all are curved—time and space rolled up into a ball, so to speak. Do not try to picture what such a universe would look like because it is impossible. What De Sitter showed was that, if his universe had corresponded to the actual one, the geometrical peculiarities alone would produce an apparent scattering of the distant nebulae, much as the curved earth appeared to "scatter" Columbus's ships. Such a theory is in fair accordance with observation. Dr. Zwicky, of the California Institute of Technology, has recently made an alternative suggestion to explain the recessional velocities of the nebulae. It remains for the future to decide which theory, if either, is correct.

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The 16 cars in the circle all look alike. 15 of them are exactly alike—but one is different from all the rest. That's the trick for you! Find this "different" car if you can—and mark it. The difference may be in the fenders, bumper, name plate, radiator, or top. Be careful now—because winner must solve puzzle correctly first in order to
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Make an Attractive Day Bed

By H. L. Weatherby

(*Continued from page* 1106)

straight in gluing. The cross rails and the vertical spindles are set with mortise and tenon joints.

In order to insure a good steady finished job, sturdy bed locks must be secured to attach the rails to the head and foot boards. These may be purchased from furniture houses and come in various styles. They may be riveted, bolted or welded to the frame of a set of steel springs, or they may be attached by bolts to a wooden frame and side rails dispensed with. No matter what style of lock is used, it will call for some mortising and fitting, and this should be done before the finish is applied.

The finish will, of course, depend upon the material used and the other furnishings into which the Studio bed is introduced. The writer recommends either mahogany or walnut stain with a rubbed varnish finish, as being highly satisfactory. Where it is possible to finish work in a lathe, the rubbing part ceases to be drudgery. Of course it is entirely feasible to do the finishing on the turned portions in this manner and assemble afterwards. Glue will not stick to a varnished surface. In most cases, however, it would probably be better to assemble before finishing is undertaken.

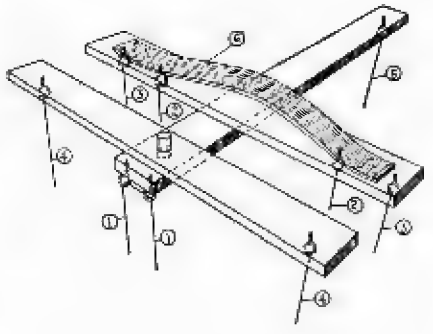
With a comfortable mattress, a bright colored, or old fashioned spread thrown over it, and some inviting cushions on it, the builder will view with considerable pride either of these day beds, when the job is finished.

Dancing Down the Centuries

By Jo La Spina

(*Continued from page* 1101)

in a dry corner until the paper has become stiff and dry, then pull out. Fix the two halves together and place the strips of paper so that they connect the two parts. Secure some stiff copper wire, make a loop at one end and push it through the paper head. Then insert another through the top and make a loop at that end. Take some water colors or oil paint and paint the head.



There are two methods of constructing the rest of the marionette. One of them is carving the two separate portions of the body and also the arms and legs from wood, and connecting them by means of eye-screws and leather hinges. This method will become apparent if the drawing to scale is followed and the various parts of the body connected as shown. The second method is to make the marionette from cloth. This may be done by securing a few yards of nainsook (white material) at any dry goods store, and also

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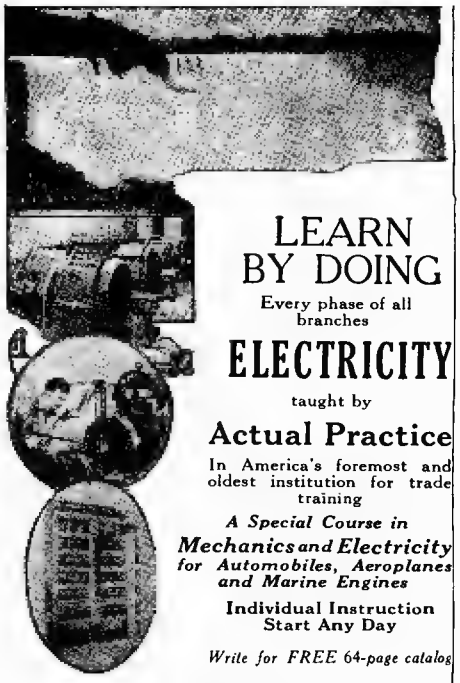

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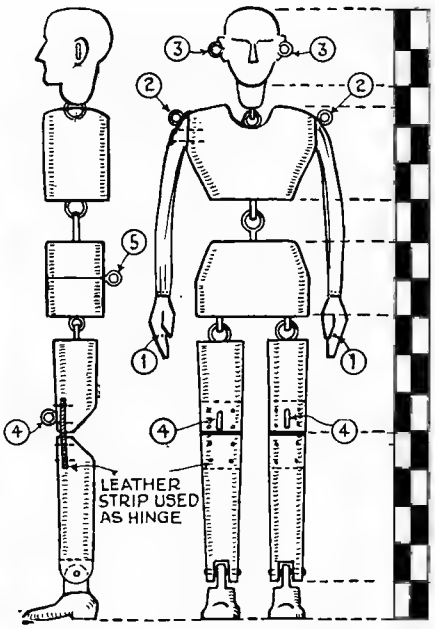
a roll of cheap cotton (absorbent cotton). Each portion of the body, including the chest, lower portion of the body, and the arms and legs, is cut out in two parts. All of these are stuffed with cotton and stitched together. The center of the arms and legs is left unstuffed so as to permit moving. Before the chest is stuffed, insert three wires through the cloth in the form of a triangle. These wires when looped will act as the connecting points for the arms and the head. Connect the various portions of the body with white bias tape. The hands and feet are made of wood and are glued to the legs and arms.

The strings are tied to the screw-eyes on the puppet, corresponding to the numbers given and then connected to the controller. For costumes, the best material available is silk, as it is light and does not interfere with the movements of the puppet. A suitable stage may be made by stringing a wire across a doorway and overlapping three separate black curtains so as to form the usual theatrical curtain. A piece of wall board may be used to form the background.



The art of marionette making and puppet acting has been known for many centuries. Ruins discovered in the tombs of the Ptolemies in Egypt have disclosed dolls and puppets which probably were used to amuse the children of ancient times. Ancient Greece and Rome also were familiar with this form of entertainment though they never adapted drama to it. It was, however, the East—India, Java, and China—which contributed most of the advancement in the art which has amused both children and adults for many centuries. In most of these countries puppet acting was, and still is, relegated to the portraying of religious drama. In Java the puppets are made as large as two feet high and fashioned into many grotesque forms to interpret the symbolism of religious feasts.

Puppet acting was brought into Western Europe in the Middle Ages. It was used mainly to portray religious drama, and rapidly spread to Italy, Germany and France.

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Book Reviews

By T. O'Conor Sloane, Ph.D.

THE UNIVERSE AROUND US, by Sir James Jeans, M. A. D. Sc. F. R. S. The Macmillan Co., New York, 339 pages.

This monumental work is so delightfully written in a style which, while somewhat familiar, breathes scientific accuracy in every word, that the best way to review it is to tell our readers to get the book and read it for themselves. It is a marvelous account of modern astronomy. It is fair to say that of all the branches of natural science, astronomy is one of the leaders and especially meritorious and remarkable in being so, because astronomers are dealing in their observatories with objects millions and millions of miles away from us. We are told in this work of stars whose temperature is so high, that the atoms of matter are wrecked in the intense heat. Protons and electrons are separated and the star acquires a specific gravity of the nuclei of its atoms which it has wrecked or destroyed. This accounts for the enormous specific gravity of some of the stars. Radiation is described. In the intense heat of the stars and the wreck of atoms, radiation is created or produced and goes off into space. No one can say whatever becomes of it. On account of this, all the stars are losing weight, possibly in some cases with the simultaneous picking up of weight from other sources. Taking our own star, the sun, as an example, it is found that it is losing at the rate of an enormous number of tons of matter per day. Even the earth is losing weight, but on account of its low temperature, the loss is infinitesimal, only a few tons per day. One interesting conclusion reached is that there are very few non-luminous stars, or stars which cannot be seen. This is a very remarkable conclusion because it touches on our planetary system, which has the planets and the satellites all non-luminous, revolving around the sun, and why should not the same thing be repeated everywhere? Yet, Professor Jeans inclines to the belief that non-luminous or obscure stars are very rare. In some books an attempt is made to popularize the subject by giving it a semi-humorous touch and this we say with a particular book in mind. But, as Edward Slosson, whose lamented death occurred very lately, in his chemistry has carried a slight touch of humor through it without lowering it, Professor Jeans, while giving it a thoroughly popular cast, abstains from any attempt to be unduly humorous.

EXPERIMENTAL SCIENCE, being a Series of Simple and Surprising Experiments in Mechanics, and Other Subjects, Heat, Light, Magnetism and Electricity. By A. Frederick Collins, F. R. A. S. D. Appleton and Co., New York, pages XVI—280.

This is quite a charming little book of simple experiments addressed undoubtedly to readers of a scientific turn of mind. The illustrations have been all drawn by the author, and to the writer of this review there is a considerable charm in this system of illustrating simple books of experimental work, which he would like to see followed more extensively. The book treats of six divisions of physics; of course, more or less of the old classic physics, which lend themselves beautifully to experiments. Space does not permit of us giving a full description of the matter in the book. It has an excellent index.

(Additional Reviews on page 1143)

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Deep Sea Surgeons Mend World's Nerves

(*Continued from page* 1097)

and make the final splice, restoring the fast cable to service.

In this section the cable was 13,200 feet beneath the surface. The Cyrus Field, built for shallow water repair work, had never before picked up a cable lower than 6,000 feet in any weather. Midwinter cable repair in the Atlantic is so difficult it is rarely attempted, especially at such great depths. The feat of the Cyrus Field, and of the Lord Kelvin, which laid 100 miles of cable in weather conditions approaching a gale, was hailed as an engineering achievement.

Such work would be impossible without every aid known to science. The ships, for instance, were aided in locating their positions by electrically driven deep-sea sounding machines which show the depth, nature of bottom and temperature on the ocean floor. Knowledge of the depth aids in finding the location, the character of bottom determines the type of grapnel to be used, and the temperature indicates what allowance should be made for this factor in repairing the cable.

Another instrument used is the Sonic depth finder, which sends sound impulses in the water so that they strike the ocean bottom and are reflected upward again to the surface. The depth is measured by the time it takes for the echo to return.

The great danger of stretching the cable too tightly or allowing too much slack is one of the major difficulties. The rise and fall of the ship on a moderately rough sea may snap the cable. If so little slack is allowed that the cable is suspended between two submarine mountains, the result may be a strain that will cause a break.

Experts in all of the various steps in the work are on board each ship. The joiner who splices the central copper wire or conductor must know his work. Equally difficult is the application of successive layers of copper tape, permalloy or numetal, gutta percha, jute, steel armor and tarred hemp cords.

Even the health of the men who work the hot gutta percha is important. A joiner whose perspiration is acid, for instance, would cause the gutta percha to harden and develop a fault. Even an imprisoned air bubble will later cause trouble, as the pressure is 8,000 pounds per square inch at a depth of 18,000 feet.

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FOR every be-barnacled cable in the ocean deeps there is maintained a duplicate on land, not in miles of cable but in "electrical resistance stages" in large numbers. Since moisture affects the delicate balance of this phantom cable, these "stages" are kept in a room like a refrigerator vault in separate compartments in the room constructed of insulating material like ice boxes. This room is maintained without moisture by use of the thermostat, electric fans and lime, which absorbs moisture. This phantom cable makes possible the sending of messages in both directions over one cable, or as the experts say, it helps to "balance" the cable.

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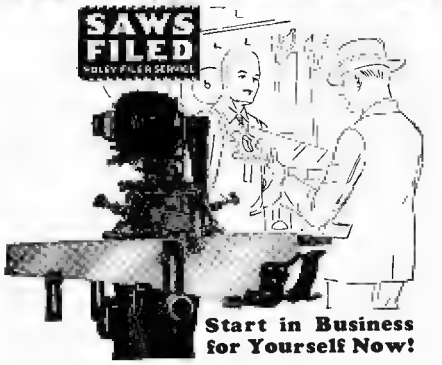

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Help Your Trees Get Their Vitamines

By Evelyn Smith

(*Continued from page* 1088)

for evergreens and for hedges. All evergreens may be sheared in the spring, if you use great care to preserve the outlines in a distinctive fashion and restrain from too much exuberance in the way of fancy shapes. There are certain flowering hedges which must be done in the spring, although the favorite privet hedge may be sheared at any time in the year. A hemlock hedge is best done in May or June, just as the young growth is starting.

If properly planted in good soil, the average tree is much better left alone by the amateur tree owner. Taste in trees and their development is as individual as is taste in furniture or in motor cars. Select and trim your own trees according to your own requirements and rely on the advice of reliable tree experts rather than on the notions of the neighbors. When your friend tells you that your favorite tree should have some big branches sawed off, remember that cutting a tree branch requires definite knowledge in order not to cut or tear either the bark or the limb. The cut itself must be properly waterproofed and painted to prevent encroachment of wood decaying fungi or other tree diseases. The amateur should no more attempt to tamper with serious tree trouble than he should attempt to do a little surgical work on his own person or to fill his own teeth.

I almost wept last spring when I saw a beautiful apple tree that had been literally done to death by an amateur, whose zeal with the pruning shears had outrun his knowledge of tree culture. The more he proudly pruned, the more he set back the lovely old tree, for he was blithely removing all the new fruit spurs. He thought that because they were a trifle twisted and seemed to be ingrowing that they must be removed. It was useless to tell him that he was ruining what should be one of the choicest trees in his orchard. It was his tree and he thought he knew. But ownership of a tree is no excuse for its maltreatment.

At Amawalk we prune our trees each year in order that the branches will not spread too much for efficient handling when shipped; but as some of our trees are from 70 to 75 feet in height and weigh approximately 20 tons this is a prime necessity. Root pruning also requires a regular program and should never be attempted by one who is not thoroughly qualified, for it takes a full year to properly make the root areas smaller, more compact and fibrous and ready for tree moving. It is not a job for the amateur, for when root pruning is done a certain amount of top pruning must accompany it to preserve the proper balance necessary in tree health.

Bear in mind that winter pruning promotes growth and summer pruning retards growth and have your plans for trimming carefully thought out for months ahead. Do no trimming of trees hastily. You can always rake leaves or mow grass or study garden catalogues to mitigate that early spring trimming itch—which is, at the final analysis, only a desire to get out into the fresh spring air and promote your self-respect by having something to show for it.

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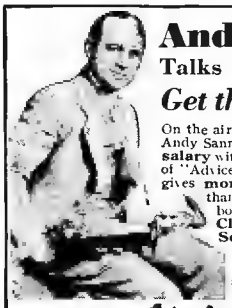

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Prize Winners and Solutions for January Brain Teasers

By Sam Loyd

Solution to Sandy MacNab's Palindrome

Inserting the letter T, in four places, makes the line read:

"TOO HOT TO HOOT," which, you see, reads the same backward as forward.

Solution to the 1930 Puzzle

An interesting digital principle applies in solving of this problem to wit:

Any group of digits continually added together, until a single figure results, will invariably have that figure as its root, no matter how the figures are varied in arrangement of rows and columns in the adding process.

The root of 1, 2, 3, 4, 5, 6, 7, 8, 9 and 0 is 9. The root of 1930 is 4. This difference in roots must by some method be reconciled in order to secure a total of 1930 from the given figures. Converting some of the figures into fractions, as permitted, will effect the desired result. Since the fractions thus made are to equal a unit, not less than four can be employed, and not more than five can be spared for the purpose, for the remaining figures will be needed to produce a total of 1929.

The digits in the created fractions (equaling a unit) must have a root of 6 in order to reduce the root 9 to 4.

The fractions 2/4 and 3/6 are found to qualify. Also the fractions 7/8 and 5/40.

1859	2/4	1923	5/40
70	3/6	6	7/8
1930		1930	

Obviously, simple transpositions may be made without disturbing the result, as for example:

1926	7/8	1850	3/6
3	5/40	79	2/4
1930		1930	

Prize Winners in January Contest

First Prize, of $10, is awarded to Alvin Ashby, Woodscross, Utah.

Second Prize, of $5, is awarded to Alexander G. Murray, 1314 Wilson Boulevard, Clarendon, Va.

The ten prizes, of $1, are awarded to the following:

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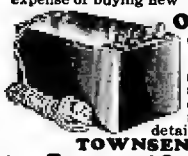

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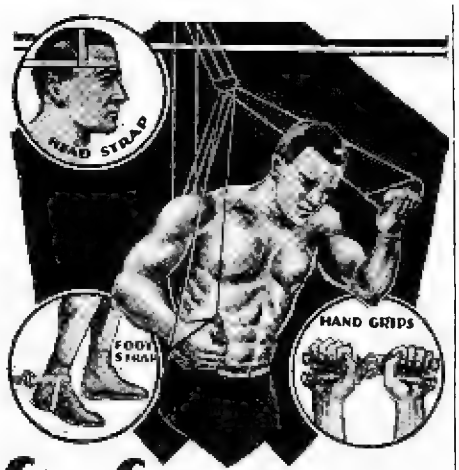

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Radio Rides the Roads

(*Continued from page* 1099)

and the lack of alignment of condensers will result. One of the best methods is to suspend the set under the hood on brackets. It may also be placed under the chassis or under the dashboard. The main consideration is to provide proper shock-absorbing insulation such as rubber or springs.

Most of the receivers designed for auto use are equipped with some form of remote control. This usually consists of a flexible shaft, similar to that used by the dentist, which is attached to the receiver at one end and to either the dashboard or the steering wheel at the other end. This obviates the necessity of having the receiver near the driver, where, no doubt, it would prove clumsy and cumbersome.

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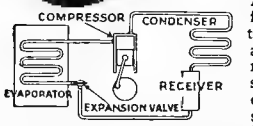

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Book Reviews

ELEMENTS OF RADIO COMMUNICATION, by John H. Morecroft, published by John Wiley & Sons, New York City, pages VI to 269.

It is impossible within the limits of our scope to review this book. The subject is so concisely treated in its 256 pages of text that the reader feels that in it is to be found the whole story of radio, simply, as well as accurately, treated. Professor Morecroft is the author of a truly monumental book entitled, "The Principles of Radio Communication," containing some thousand pages of text, and this book is considered as the final word in radio literature as far as the English language is concerned. The book we are reviewing, which is about one-quarter as long, seems to be constructed exactly on the right level. There is no attempt in it at simplification. It is not too much to say that it is all there—all radio. Formulas are used and numerous calculations by the formulas are given, but the derivation of the formulas is often passed over. For this part of the subject, as given by Professor Morecroft, all that is required is a knowledge of the simple operations of algebra. It is fair, to say that unless a radio student is willing to go through this altogether admirable book, word for word, applying the formulas and doing the problems which are given, he cannot consider himself as anything better than a service man. And the person who wishes to round out his knowledge of radio will find from this book that there is no excuse for the least difficulty in understanding the basic principles of radio. It supplies an admirable framework as well as details for giving him an excellent knowledge of this subject. We can compliment the book by saying that it deserves a better index than has been given it, and we think we have noticed one or two minor points which could be changed in a future edition, but they are slight. It is intended as an introduction to the standard work, "Principles of Radio Communication," and it is hard to believe that anyone will go through it with the diligence which it deserves without following it up by studying the above larger really monumental work by Professor Morecroft, assisted by A. Pinto and W. A. Curry.

RADIO LIBRARY, flexible fabrikoid, 7½" x 5", five volumes, profusely illustrated. Published by International Textbook Company, Scranton, Pa.

In this edition of five volumes the aim has been to incorporate everything in radio, from the fundamental principles of this science to the practical problems of the service man. The editor seems to have achieved his end by securing authors, who not only know their radio, but also know how to write about it. This edition gives a lucid explanation of the fundamentals of radio receiving and transmitting circuits; besides a comprehensive discussion of tubes, antennas, and radio mathematics. It is really very difficult to do justice to this series of books in a short review, for there is no doubt that the matter covered is very comprehensive. Some of the chapters we liked best were those on receivers—the explanations of the underlying principles of the neutrodyne, heterodyne, and regenerative circuits. Another thing we liked was the glossary of radio terms. Outside of a radio dictionary we have never come across such lucid definitions. However, the library has its faults, one of them being that its chapters on servicing sets do not go into enough detail.

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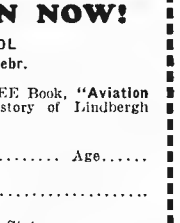

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This is a new Colonial Bungalow---cozy, convenient---yet a roomy house. It is meeting with such popularity that we are desirous of obtaining a suitable name for it for use in connection with our building program, and will pay $500.00 cash for the most suitable name suggested. There are no strings tied to this offer. Sending us a name for this house does not obligate you in any way. Nothing to buy or sell. We merely want a suitable name and are willing to pay $500.00 in cash for the best one sent in. Surely you can think of an appropriate name for such a beautiful home. Do not use more than two words. Any word or words may be used or any combination of words, such as Ridgelawn, Shadynook, Hearthome or names like Sunshine Inn, Journey's End, etc. No matter how simple your suggestion is, you cannot afford to neglect sending it in at once. Any name may win. Possibly you may have the most suitable name right on the end of your tongue this minute. If you have, send it in at once, and $500.00 in cash is yours, or $600.00 if sent within 3 days.

$100 EXTRA FOR PROMPTNESS

We want the name for this house quickly, and will pay the winner an extra $100.00 cash just for promptness—or a total of $600.00 in all. Send your suggestion today! The very first name you think of may be worth $600.00 cash to you.

FOLLOW THESE RULES This offer is open to everyone, excepting members of this firm, its employees and relatives. Each participant may send only one name. Sending two or more names will cause all names submitted by that person to be thrown out. Contest closes June 28th, 1930. Should two or more persons submit an equally suitable name for this house, the full amount of the prize offered will be paid to each one so tying. To win the $100.00 CASH PROMPTNESS PRIZE, the winning name must be mailed within three (3) days after this announcement is read. This $100.00 CASH PROMPTNESS PRIZE will be added to the $500.00 prize and paid to each one submitting the winning name, provided suggestion is mailed within three (3) days after this announcement is read. Any easy, simple name may win.

FREE! In appreciation of your suggesting a name for this house real quickly, we will send you FREE and POSTPAID, the floor plans and blue print of this beautiful house. Understand, this does not obligate you in any way. Rush us a name for this house TODAY—QUICK. A postal card will do.

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CENTRE PUBLISHING CO., 1123 Broadway X-45 New York

Deafness Yields to Galvanic Current

By Emanuel M. Josephson, M. D.

THE human hearing mechanism is subdivided into four parts—the outer ear, or ear canal, which transmits sound from the ear into the head as far as the ear drum; the middle ear, which serves as a protective resonating and transmitting mechanism; the inner ear, which converts incoming sound waves into nerve impulses into the part called the cochlea; and the vestibular apparatus, the human spirit level, indicating change of position of the head; finally the nerve and brain mechanism, which makes the nerve impulses which have risen in the inner ear intelligible.

Malady of any part of this mechanism may cause impairment of hearing or deafness. Blocking of the outer ear canal will deafen a person temporarily. Chronic ear abscess and chronic mastoid, even though the discharge may be so slight in amount as not to run out of the ear, may cause impairment of hearing because of the underlying infection. It is surprising to find that though this is the most dangerous form of chronic infection in the body (the ear lies directly next to the brain and to the large blood vessels of the head), the chronic running ear is very frequently neglected by both physician and patient. The general method of procedure with the chronic running ear is to wait until the infection has spread and threatens life and health, and then to do a radical operation on the mastoid, which results in loss or impairment of hearing. Over 90% of these chronic ear cases if taken in hand and treated by the newer medical methods, can be caused to heal without operation. The modern medical treatment of chronic ear trouble results in a large majority in a restoration of hearing. Contrary to the impression widely held, the destruction of the drum and of the little bones in the middle ear does not seriously impair the hearing, for their primary function is to act as a shock absorber for the inner ear. On the other hand, disturbance of function of these bones, due to spasm of the tiny muscles attached to these bones, results in loss of hearing due to pressure disturbances in the inner ear affecting its blood circulation, which is rendered permanent in the course of time by bony changes in the window in the inner ear, into which the last of these bones fit, which bony changes are labelled otosclerosis.

Acute disease of the inner ear, or its injury, often results in a destruction of the nerve endings of hearing and in deafness. The inner ear lies in a bony capsule in the base of the skull and is a delicate structure. Though the inner ear be well protected, severe blows and falls on the head frequently injure its structure, though there may be no noticeable evidence of the damage at the time of injury. In some rare cases of deaf-mutism the patient may have been born without an inner ear. Chronic progressive deafness has been regarded, in the past, as a disease limited to the inner ear and to adjacent structure of the middle ear, but recent findings by the writer contradict this previously held idea.

Chronic progressive deafness, or otosclerosis as it is frequently misnamed, is an intensely disagreeable and pathetic malady which affects principally individuals in the prime of life, young mothers and young folks just about to make a place for themselves in the world. The disease has probably played an important part in world history. Martin Luther, according to his own accounts, was severely troubled by

(*Continued on page* 1154)

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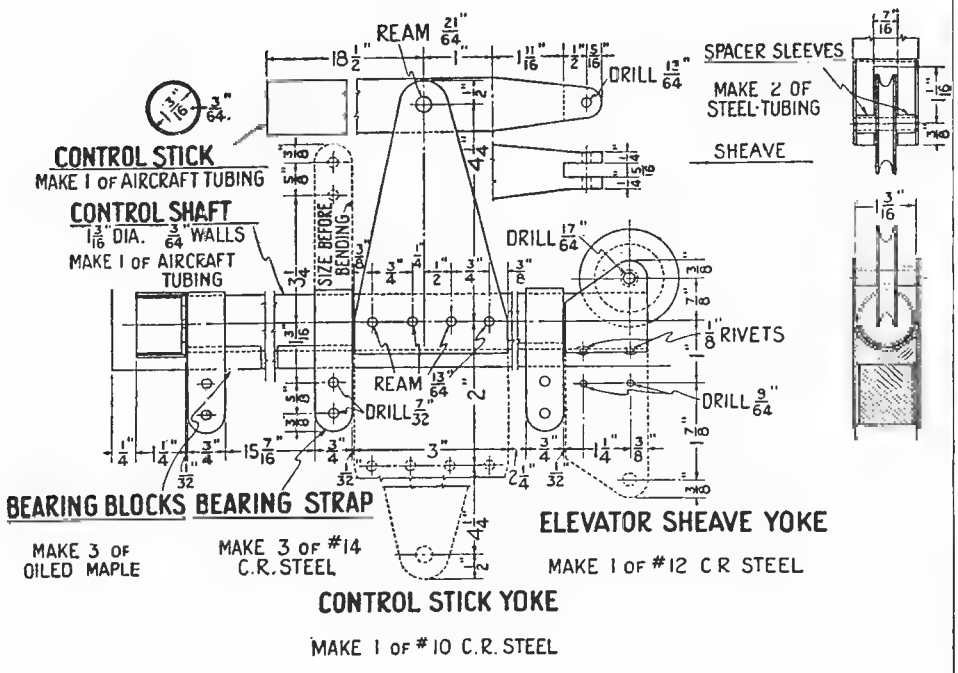
One More Step to the Take-Off

By Lieutenant H. A. Reynolds

(*Continued from page* 1103)



straight edge you can mark the course of the long holes through the wood work for the elevator cables. These holes should be carefully bored with a long ¼" bit. If the cables bear slightly against the sides of these holes later it should be no cause for concern, for the resultant friction will not cause noticeable drag. The control stick assembly can be bolted in place allowing about 1" clearance at its rear end. The top elevator control cable should just clear the top of the metal tube at its back end.

The rudder bar is made of ash to the dimensions shown in the drawing. It can be fastened in place on the bolt previously placed on the top of the runner and should have a bearing surface provided by wide, flat metal washers on its lower side and under the bolt nut on its top.

Single Pulley Sets

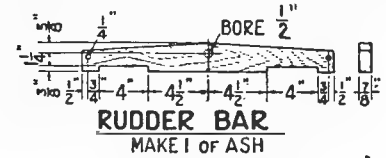
THREE single pulley sets are made of carbon steel No. 14, with one aluminum pulley to each set. All the sets are bolted to wooden members and, if the builder prefers, a metal wood screw can be screwed tightly into the member instead of the rivet bearing for the aluminum pulley.

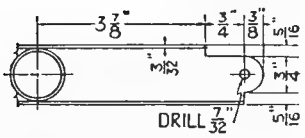
One of these single pulley sets is bolted to the back of the butt end of each front main spar in the wing framework. If the aileron pulley sets have been previously shimmed away from the spars to allow the control cables clearance from rib uprights, the single pulley sets should be shimmed likewise. The purpose of the single pulley set in the wing is to allow the top aileron control cable to feed directly to the aileron lever arm on the back end of the control stick assembly. Therefore locate the single pulley set on each front main wing spar as nearly in line with the control stick aileron lever as possible. Make these positions the same in both wings.

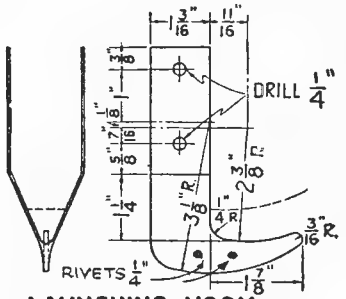
The remaining single pulley set is bolted through the plywood top and longest streamlined strut of the main skid section just under the top F. 14 metal fitting. It is over the aluminum pulley of this fitting that the top elevator cable is to be led.

The two wings are next bolted to the main skid section with ½" coupling bolts, through the F. 11 and F. 5 metal wing connection fittings. The wing tips are raised to their approximate flying position and blocked up by tall saw horses or wood strips which can be temporarily nailed to the front and back wing spars. It is best to measure the distance from the under surface of the

(*Continued on page* 1150)







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Do you look with envy and hatred upon the man who stands out in a crowd the picture of health and vigor and strength—the real manly fellow? Do you sneer at the peppy pugilist, the powerful wrestler, the speedy runner, the graceful dancer—do you call them "big stuffs"?

Beware, man, if this is your feeling toward strong healthy men—you are filled with jealousy. You feel your own weakness. In your heart you wish you were like these fellows. You want to be strong and healthy. You want to command the attention of men and the admiration of women—you wouldn't be half a man if you didn't. You know your own weaknesses even if you are hiding them from others, and you envy those who are your superiors — those who seem to get the center of the stage wherever they are. They are the "life of the party" always, everywhere. They are the fellows who get all the promotions, all the good jobs.

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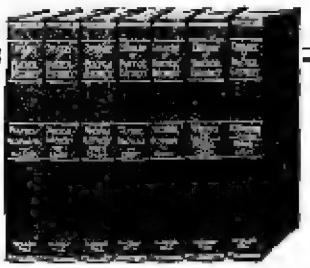

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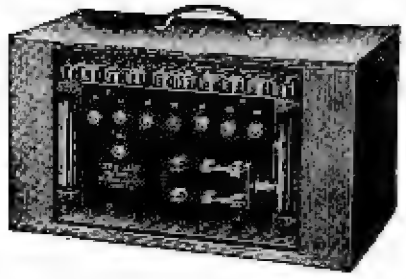

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A Great Lake City

(*Continued from page* 1092)

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Most of the dredging machinery used in building the Panama Canal came from a Milwaukee plant—that of the Bucyrus Company. The fame gained by this company's products in Panama brought orders for its machinery from throughout the world. Its most recent major triumph took place in far-off India where, after testing the Milwaukee excavators against those manufactured by its own nationals, the imperial British government awarded the American company contracts for ninety per cent. of the machines needed to carry out the great Indus irrigating enterprise. Powered with internal combustion engines, and manned by sixty-men crews, some of the Bucyrus units in the Indus area are performing the equivalent of the excavating work that could be done by 1,500 men.

The outstanding aeronautic enterprises of Milwaukee are the Hamilton Aero Manufacturing Company, makers of propellers, and the Hamilton Metalplane Company, producers of all-metal monoplanes. Other aero products include pontoons, fliers' clothing, paints, motor oil, hangars, wind indicators, landing lights, tires and miscellaneous accessories and supplies.

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Solution to Puzzle on Page 1128

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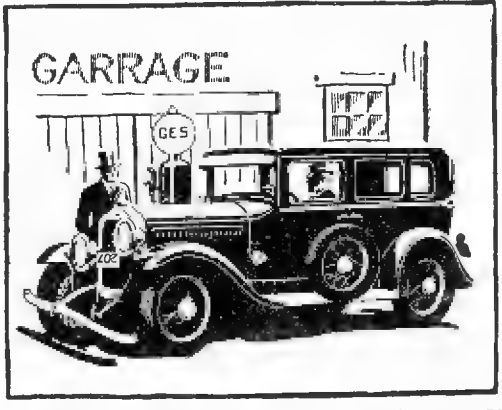

HOW MANY MISTAKES CAN YOU FIND?

The artist was evidently in a hurry drawing this picture and made several mistakes. Can you see what's wrong? How many of the errors can you find? Study the picture line by line and mark each mistake you find with a cross like this: X. Find at least five of the errors, tell me where they are and I will show you how easily you can

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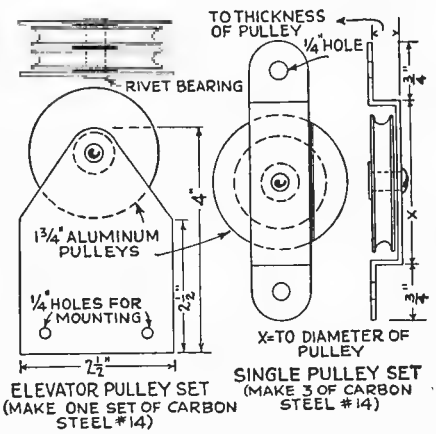
One More Step to the Take-Off

(*Continued from page* 1145)

wings to the floor under the front and back spars, at the rib section nearest the wing connections. The distance beween the under surface of the wing and floor should be the same at the last rib found at the wing tips.

Wiring

YOU will need 23 good standard airplane turnbuckles to complete the wiring of your glider. The Heath Airplane Co., 1721 Sedgwick St., Chicago. Ill. sells a No. 326-S.F. or S.M. turnbuckle, with a minimum strength rating of 2,150 pounds, for 35 cents each. These turnbuckles are very satisfactory for this use. Do not use weak turnbuckles found in hardware stores and


TO THICKNESS OF PULLEY
¼" HOLE
RIVET BEARING
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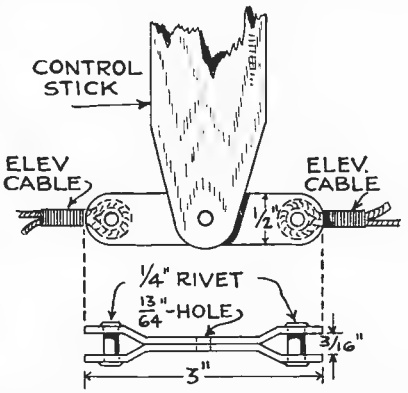
X=TO DIAMETER OF PULLEY
ELEVATOR PULLEY SET (MAKE ONE SET OF CARBON STEEL #14)
SINGLE PULLEY SET (MAKE 3 OF CARBON STEEL #14)

sold for general use. The hard wire ferrules shown in the drawing for bending the hard wire end loops can also be purchased from the Heath Co. at 2 cents each.

Rivet or bolt a turnbuckle between the long metal straps in each top and bottom F. 22 wing brace clamp. Using No. 34 hard steel piano wire or No. 12 plated aviator wire, which can be secured from the Heath Co. for 60 cents a pound, cut the four lengths necessary for the top flying wires. Leave enough extra wire at each end beyond your measuring mark to form the five bend system shown for making your hard wire end loops. The hard wire ferrules should be slipped over the wire before bending the loops and the wire should be examined after bending to see that



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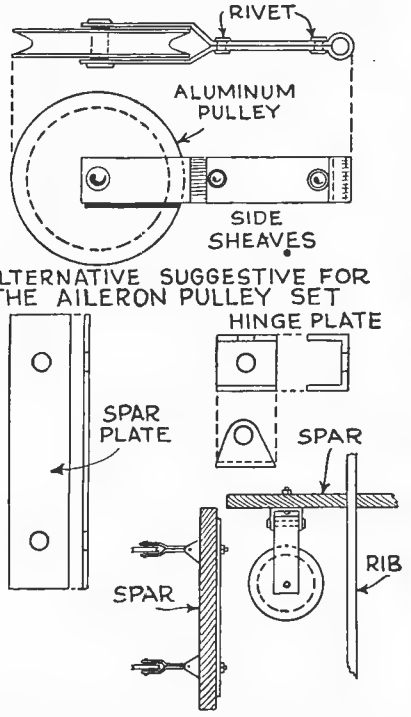
no scratches, splits, or crystallized spots have developed.

After securing the top flying wires proceed in the same manner with the four bottom flying wires. The positions of all these rigging wires are shown in the top view of the glider.

The two wires running from the F. 11 fittings at the rear of the main skid section to the F. 4 fittings on the back surface of the back main spars are next



installed. It is best to have the turnbuckles in the wire just below the wing surface to eliminate wires dragging from the wings later when taking the assembly apart. The tail section can be bolted into place and the wires leading to it installed with their turnbuckles also near the surface of the wings. The two stabilizer support wires can next be installed. After attaching the elevators and rudder you are ready to install the control system.

The control wires are flexible cable to facilitate their easy movement over the aluminum pulleys necessary in the control system. The Heath Co. sells 3/32" flexible aircraft cord at $4.50 per 100 feet which is very satisfactory. The writer has successfully used a good grade of flexible metal strand sash cord ⅛" in size and puchased at a local hardware store for 3 cents a foot. This cord should be strongly twisted and have a cotton core. It should hold at least 700 pounds strain.

Cables

THE aileron cables are first installed. The top aileron cable is brought from the top of the aileron horn over the top double pulley and along the inside of the wing to the single pulley set where it turns down and out of the bottom of the wing to its connection on the aileron lever of the control stick assembly. The turnbuckle for tightening this cable is best placed at the aileron lever of the control stick assembly. The bottom aileron cable is brought from the bottom of the aileron horn over the bottom double pulley and along through the wing to a turnbuckle which passes through a 1½" hole in the top of the main skid section. The bottom aileron cable next passes from this con-

(*Continued on page* 1152)

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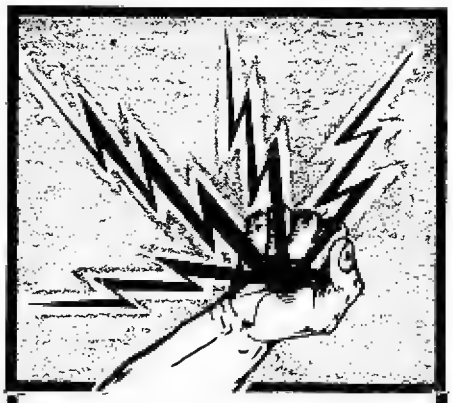

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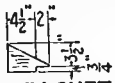
One Step More to the Take-Off

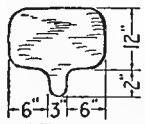
(*Continued from page* 1151)

necting turnbuckle along through the other wing to the bottom double pulley of the double pulley set in that wing and then to the bottom of the other ailerons easily. When the stick is moved free from any obstruction and move the ailerons easily. When the stick is moved to the left the left aileron should move up and when moved to the right the right aileron should move up. The elevator cables are next installed by connecting cables to the control stick connection link at the pointed end of the control stick. The rear cable from this link feeds back through the top hole in the woodwork, under the elevator pulley set, and up over the single pulley set from which it is led to the turnbuckle connection between it and the two elevator top horns. The front cable leading from the connection link runs forward over the aluminum pulley in the front of the stick system and back through the horizontal tube continuing through the bottom hole in the woodwork and under the elevator pulley set, from which it is led to the turnbuckle connection between it and the two bottom elevator horns. When the stick is pushed forward the elevators should flap down and when pulled back the elevators should flap up.

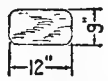
In wiring the rudder control run a No. 24 piano wire from each rudder



SEAT BRACKET
MAKE 2 OF $\frac{5}{8}$" SPRUCE



SEAT
MAKE 1 OF $\frac{3}{8}$" 3 PLY BIRCH



SEAT BACK
MAKE 1 OF $\frac{3}{8}$" 3 PLY BIRCH

horn side to the rudder bar end on the same side. Facing the front and pushing the rudder bar with the right foot should turn the rudder to the right.

It is well to oil all the aluminum pulley bearings and make certain that each control works smoothly and firmly. This is an excellent time to examine all the cable connections and check the amount of available take up in each turnbuckle.

Construction of the wing framework, elevator, stabilizer, and tail and main skid sections was described in the February and March numbers.

Floors That Clean Themselves

By Mrs. Christine Frederick

(*Continued from page* 1108)

backnumber, however, as it is wrong in principle. The film of oil left on the floors is merely a trap for dust, and every footprint shows; to say nothing of the bad effects of getting oil upon rugs. Some of the electrical floor machines are equipped to *scrape* the floor—to make it over into a new floor entirely. To see one of these scraping machines in action, and then contrast it with the old hand

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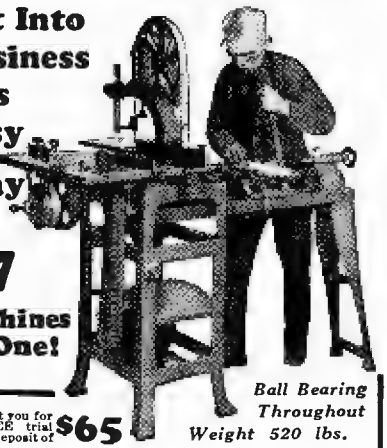

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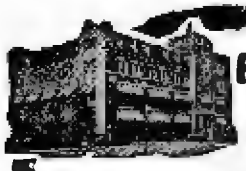

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work of scraping is like seeing the *Bremen* alongside of a canal boat.

We are also becoming wiser in building floors. We are making more cement or composition floors in homes. It is a startling fact that 75% of home fire-losses start in the basement, so that by using steel beams and concrete for the first floor, we not only get far safer homes, but also floors more readily cleanable. There are various forms of composition flooring, and by carrying it up to baseboard height around the rooms, the sanitation and cleaning problem is brought up to the standard of hospitals or public buildings. The electric scrubbing machines are, of course, especially effective in washing down such concrete or composition floors. Tile is more and more becoming interesting, and the cleaning problem thus even more simplified.

In recent years vacuum cleaners have been made more powerful in their suction and adaptable to home uses; they present a great factor in cutting down the energy needed for keeping floors in condition. Many women have taken advantage of the use of modern equipment to greatly enhance their standards of cleanliness. Whereas, under the old back-breaking methods, they achieved a weekly clean-up, they now have a *daily* clean-up; and as any woman knows this is a far better system, preventing unhealthy accumulations and an over-laborious cleaning time.

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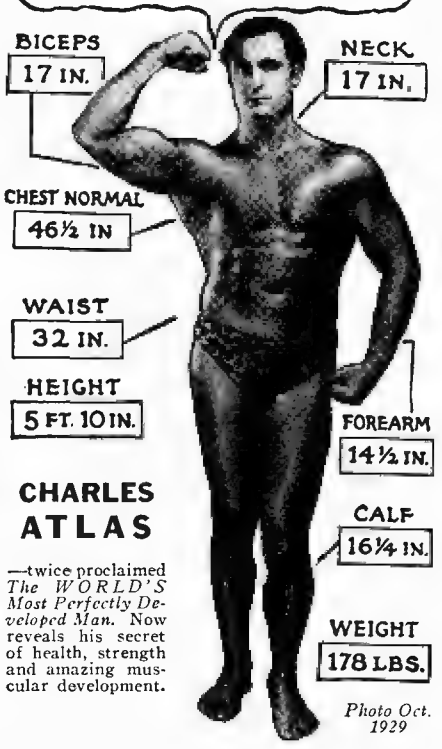
Therefore, the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."

"Give me your measure and I'll PROVE that you can have a body like mine"



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Deafness Yields to Galvanic Current

By Emanuel N. Josephson, M.D.

(*Continued from page* 1144)

the annoying head noises, which are symptom of the disease, and attributed them to the activities of demons who were besetting him in his work. He wrote: "When I work, my head becomes filled with all sorts of buzzing, whizzing and thundering noises, and if I do not leave off the instant I should faint away. For the last three days I have not been able to look at a letter. The day your letter came from Nurmberg, I had another visit from the devil. I was alone . . . and this time the devil got the better of me, drove me out of my bed and forced me to seek the face of man. Not seldom has it happened to me to awake at midnight and dispute with Satan concerning the Mass." One night he was awakened by the noises. "Is it thou, devil?" he shouted, but Satan did not answer. Then Luther concluded that the devil would not be drawn out and returned to sleep. These noises which accompany chronic progressive deafness are often the torments of Hell for the victims of the disease.

Like cancer, chronic progessive deafness has been regarded in the past as a mysterious disease, the origin of which was unknown. The doctor specializing in diseases of the ear has been able to diagnose chronic progressive deafness and to predict that the patient would eventually lose his hearing, but he has not been able to influence the symptoms or to relieve the deafness and other symptoms. To be sure, it has been realized that the symptoms vary in severity with changes in weather. The patients complain that their deafness and noises are often intensified in rainy weather. Careful study of these variations and associated weather changes has revealed that the factor which controls these variation in symptoms is changes in barometric pressure. Even slight changes of barometric pressure, one-half an inch of mercury, may cause marked changes in the symptoms of the disease; but the sum total of a change of a half inch of mercury pressure over several hundred square inches of body surface probably exert an appreciable effect on blood circulation. These variations in the symptoms of the disease have indicated that the theory previously held that bony changes in the inner ear capsule of the ear are responsible for the deafness are untenable. For it is known that such rapid changes in the structure of bone, as might account for the rapid variation in symptoms, are not possible. That the disease has baffled medical science is indicated by the formation of an international committee, under the auspices of the American Otologic Society, for the sole purpose of studying this disease.

The writer, working independently of any hospital or otologic society, has brought to light some interesting and important data regarding the disease, including a method of relieving the symptoms and treating chronic progressive deafness with a measure of success; as well as a theory as to the cause of the disease which is proven correct when put to test. Though many different causes have been ascribed as the cause of the disease by various investigators, among which are syphilis, disorders of body chemistry, disorders of glands of internal secretion, and others, it is becoming increasingly evident that any condition which results in impairment of the blood circulation in the inner ear will eventually cause the disease.

Direct proof of the part which the blood circulation plays in this disease has been offered by clinical observation of the patients. The administration of drugs which are known to directly affect the blood circulation markedly influences the hearing. The administration of small doses of nitroglycerin to a patient suffering of a less advanced form of chronic progressive deafness results in a momentary improvement in hearing, and it is known that nitroglycerin dilates the blood vessels; whereas the administration of ephedrin or adrenalin, which is known to contract the blood vessels, generally results in a drop in hearing in these cases. The negative pole of the galvanic current applied to the ear has proven to give the same improvement in hearing as is given by the drugs which dilate the blood vessels without the unpleasant by-effects of the drug.

The improvement obtained in early cases of chronic progressive deafness by these means is frequently astonishing. The range of hearing improves, the noises are alleviated, and the disturbances in the muscles of the middle ear above mentioned, which cause the so-called retracted drums in many cases, are relieved. In the more advanced cases the results are slower, for another factor enters. The nerve endings which translate the incoming sound waves into nerve impulses of sound, and sometimes the nerve itself, have become wasted and incapable of functioning, due to cutting off of their nourishment brought to them by the blood vessels. The process of regeneration, or rather reactivation of the nerve ending, is increasingly prolonged and doubtful, in proportion to the length of time which they have not been nourished and functioning. Patience is a prime requisite in obtaining a result, as is also a thorough knowledge of medicine and a large measure of skill and experience. The treatment may extend over many months of slow and intermittent progress.

Results are not obtainable in all cases of deafness. Deafness of the chronic progressive type is a not infrequent symptom of tumors and other disease changes in the brain. In such cases the treatment of the deafness is of no avail.

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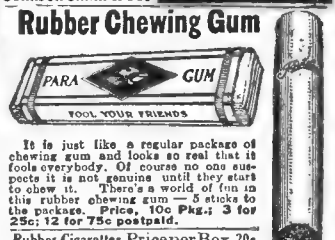

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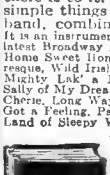

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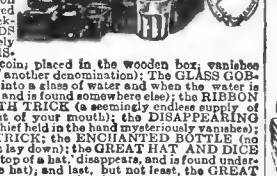

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The Safety Valve

(Continued from page 1115)

guests of Sir Oliver Lodge, and of the British Society for Psychical Research, London, and read the true evidence adduced from the record as to how thoroughly Margery is constricted when seances occur. I also note that Arthur Ford of New York offers anyone $10,000.00 to prove he got the wrong message for Mrs. Houdini, or that she did not pay him the $10,000.00. Where is Dunninger? Put him on.

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(Let us first say that Mr. Ford never received $10,000.00 for giving the correct message to Mrs. Houdini. Mr. Ford admits so himself under his own signature, yet newspaper accounts state that he did receive the $10,000.00. This, Mrs. Houdini denies.

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Austin C. Lescarboura, in answer to a storm of inquiries, tells why radio opportunities seem few, in spite of the great demand for trained men.

Commander Edward H. Loftin and S. Young White explain how to add a direct-coupled amplifier system to a standard radio frequency tuner.

A. Binneweg, Jr., discusses his experiments in the short wave field, developing transmitter equipment for 2.5 and 10-meter use.

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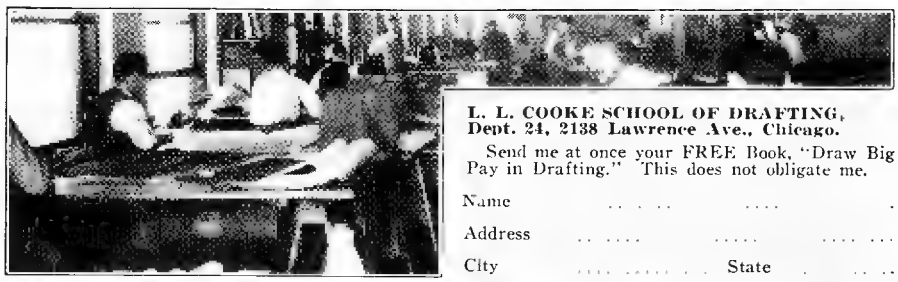

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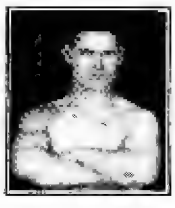

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When the Fates Fooled Dunninger

By Dunninger

(*Continued from page* 1105)

catch in a week or two! Imagine that!

While doing handcuff escapes on the stage, I once issued my customary challenge to police officers to bring their own cuffs, from which I would release myself upon the stage. As I spoke I noticed a man seated in the front row dropping buckshot into the locks of his pair of handcuffs. It is impossible for anyone to free himself from handcuffs that have been doctored with buckshot. Saying nothing, I invited a committee upon the stage to examine the cuffs and assist in manacling me. Up stepped the wise guy carrying his handcuffs. Watching my chance, I took the handcuffs from him and grasping his wrist, snapped a cuff onto his wrist, pressing the side catch. Then I said, "I want to have the ladies and gentlemen out there see how easy it is for you to open those cuffs of yours with the key!"

Picture my predicament if I hadn't by sheer luck glanced in his direction when I first made my entrance on the stage!

I could unfold a thousand and one tales of the mishaps, the laughs and the comical situations that have arisen during my various entertainments before celebrities and in the homes of the élite. After showing a few magical tricks to the Prince of Wales he said to me, "Say, Dunninger, when you come over to England I want you to meet the folks and show them a few of those tricks, will you?"

When the entertainer least expects it, drama creeps into his work. I will never forget the thrill and fright I received one night that the people out front never suspected. Even my own assistants didn't know at the time what a narrow escape I had from being suffocated to death.

It came about in this manner. . . . I used to feature a thrilling strait-jacket release and the escape from a large safe, borrowed from the leading safe dealer in whatever town I was playing. One night I would do the safe trick, the next the strait-jacket release.

This night I stepped out on the stage and announced I would endeavor to make my escape from the safe. In this trick I used a searchlight so as to see the darkness of the safe in order to operate the tumblers from within. It perhaps isn't generally known, but tumblers in a safe can be operated from the inside by anyone understanding their workings by removing the plates after taking out the screws which hold them in place.

On the heels of the announcement a voice in the audience rang out: "I demand that you, Dunninger, escape or make an attempt to escape from this strait-jacket which I brought from the Such-and-Such asylum!"

"But, my dear sir, tonight I have scheduled my escape from this safe," I announced to the challenger as I pointed to the large safe which stood on the stage.

"Makes no difference. I insist on the strait-jacket!" called the man in the audience.

"If you insist, sir, I shall leave it to the audience, whom I am here to please." I expected the audience to pass his challenge up—but they yelled that I should do both the strait-jacket escape and the safe release! So I had to do them.

I requested the challenger to step upon the stage with his restraint jacket—one used only on the most violently insane unfortunates.

Stripping off my coat, in the pockets of which were my small trusty screw-driver and searchlight, I tossed the coat over a chair. During the process of being manhandled and buckled into the restraint apparatus, I forgot all about it.

Officers recruited from the audience who assisted in the operations were experts in their line. I was handled none too gently, and the spectators out front seemed to sense this, for hisses greeted the efforts of the strong-arms.

When I was bound in approved asylum style I requested the committeemen to stand to one side. In full view I managed to make my escape from that murderous restraint jacket.

A thunderous volume of applause greeted my release and for a few moments I stood, nearly exhausted, bowing my thanks to the audience for their generous applause.

When I had regained my breath, I was ready to try the safe trick. The safe was opened, I stepped into it, and it was quickly locked. I knew my assistants were wheeling my cabinet around the safe to cover my escape methods from prying eyes. I was ready to work. I placed my hands in my pockets . . . pockets that were not there! Then I remembered.

My coat was outside on a chair—and I had neither screw-driver nor search-lamp!

Here I was in total darkness, with barely enough room to move, and without the necessary means of making my escape!

And they say the work of an escape artist is a sinecure!

Fumbling as best I could with the plates over the tumblers . . . with the oxygen rapidly being used up . . . with no means of attracting or signaling my assistants . . . I was gradually enveloped in a panic! Beads of perspiration dripped from my forehead striking my cold, nervous hands like drops of melted lead. . . . I fought the panic and fear that were slowly getting the best of me.

Searching in the back pocket of my trousers I got out my key-ring. The gods were with me! I had a sort of screw-driver fashioned some time before with a file, at the end of a long skeleton key . . . in my panic I had entirely forgotten it.

Now I set to work again on the plate covering the tumblers of the safe. My head seemed ready to burst . . . my tongue was parched . . . my head splitting . . . I tore the collar from my dress shirt . . . then the neck . . . I must continue to breathe . . . finally the tumblers clicked into place. . . . I was free . . . free!

I had just enough strength left to push open that door . . . the sounds of the orchestra sounded faintly in my ears . . . I staggered forward . . . fell . . . then darkness!

When I came to, I was seated in a chair back stage. A doctor was holding a bottle of smelling salts to my nostrils. My assistants and the stage crew were standing about, with faces as white as sheets.

"Narrow escape that!" voluntered the physician.

"Dunninger, we were afraid you were gone!" my first assistant told me.

"The lamp and the screw-driver were in my coat——" I was too weak to talk.

"Yes. I found that out after they had locked you in," replied my assistant.

"That safe stuff is out from now on!" I managed to say.

Fervently I heard my man, who had been with me for several years, reply, "Amen!"

And never again, in the several years I continued to do escape stunts, did I include the escape from a borrowed safe!

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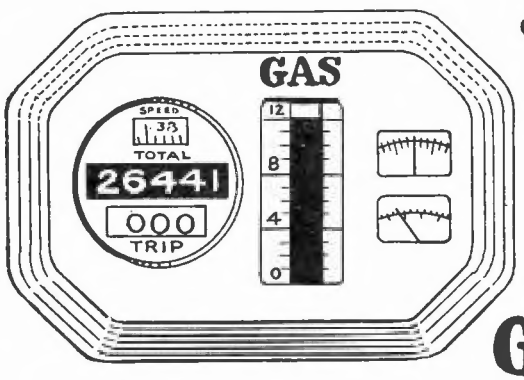

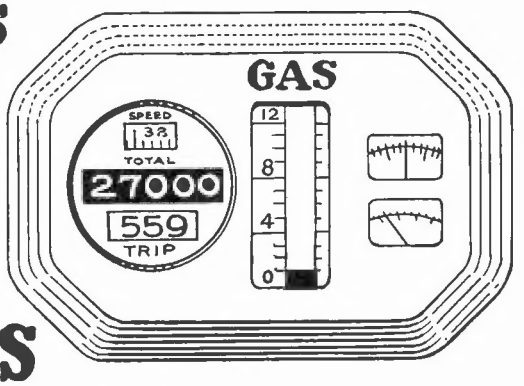

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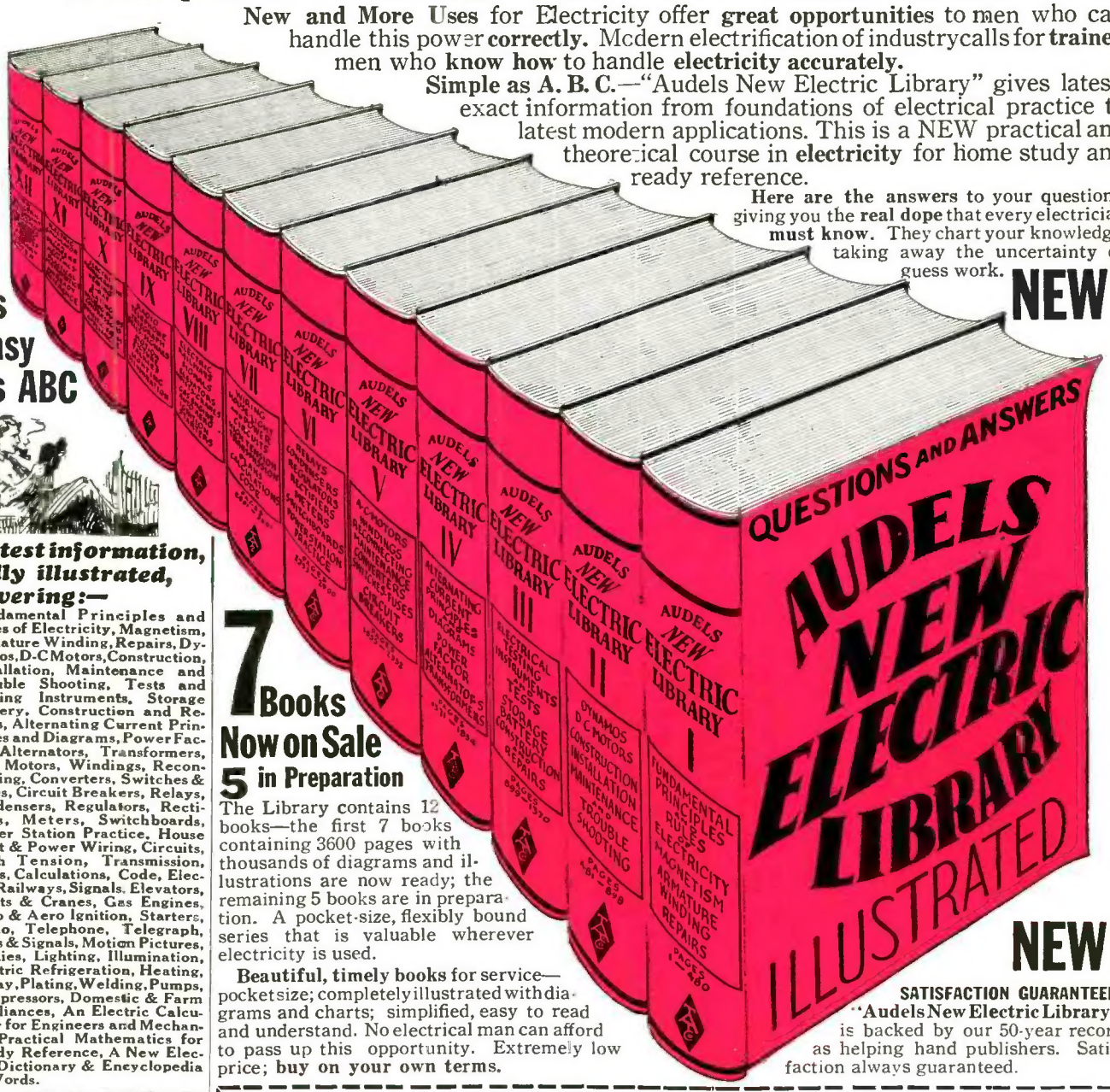
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Ship me the Corona, F. O. B. Chicago. On arrival I'll deposit $2 with express agent. If I keep machine I'll send you $3 a month until the $37.90 balance of $39.90 price is paid, the title to remain with you until then. I am to have 10 days to try the typewriter. If I decide not to keep it, I will repack and return to express agent who will return my $2. You are to give your standard guarantee.

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